ENVIRONMENTAL OVERVIEW

TASK FORCE ON NORTHWEST ECONOMIC DEVELOPMENT OPPORTUNITIES

ENVIRONMENTAL AND SOCIAL IMPACT

WORKING GROUP

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PREFACE

During late 1981 and early 1982, the Cabinet Committee on Economic Development made a series of fact-finding visits to northwestern British Columbia. In response to briefs presented by a large number of private citizens, corporations and public groups, the Cabinet Committee commissioned a report which was to summarize the area's economic potential. That report, The Northwest Region, A British Columbia Regional Economic Study, was released on September 15th, 1982.

The September, 1982 report states that the area north of the Highway #16/CNR northline corridor has substantial development potential, based mainly upon the significant, but largely undeveloped, mineral resources. However, this area lacks virtually all of the necessary infrastructure to sustain early large-scale development. Lack of both transportation and municipal facilities and adequate, reasonably-priced power are seen as significant constraints to development at the present time. The report concludes that development of minerals and other resources will require substantial private and public sector investments. However, such investments can only be made after careful planning and consideration of the alternatives.

In response to the September, 1982 report, the Cabinet Committee on Economic Development directed an Inter-Ministry Task Force to begin work on a series of detailed studies on the northern part of the Northwest region (i.e. that area from Stewart northwards to the Yukon border). These new studies were expected to determine the scale and timing of potential mineral developments, and to identify options to supply power, transportation and community infrastructure facilities in order to serve these mineral developments. The Task Force was also required to identify the social and environmental issues which might arise as development proceeds.

The product of these studies consists of six Inter-Ministry Task Force reports on mineral resources, transportation options, power supply alternatives, community development, social issues and potential environmental impacts, plus a summary report which includes the findings of the six background studies. It should be emphasized that these reports do not represent a blueprint for development, but rather indicate priorities for future planning and development. The reports identify options and, as far as is possible, both the negative and positive factors associated with each option. Final decisions on any specific development option would be premature at this stage. Such decisions will have to await further analysis and more concrete private sector proposals for the development of the resources of the region.

It should be noted that, during the course of these studies, the mine development scenarios were refined as more information became available. These scenarios have been updated in the background reports, where possible. However, in the power supply report and the transportation report, the analysis is based on the original hypothetical development scenario. Moreover, the Environmental Overview report is based on early definitions of the development options by the other working groups. The conclusions of these three reports are not materially altered by the refinement of the original development scenario.

NOTES ON ENVIRONMENTAL OVERVIEW REPORT

The Environmental Overview report summarizes the results of a questionnaire survey conducted among Provincial Government resource Ministries. The survey posed questions relating to potential development options in northwestern BC. Given the highly preliminary nature of the development options and the current relative lack of regional baseline resource information, this report is based primarily on the personal knowledge and professional judgements of the resource managers who responded. These judgements may be subject to modification in the future, as more development-related information becomes available.

As mentioned in the Preface, there are a few discrepancies between the development options as defined in this and other working group reports. The ESIG was not in a position to adjust its definition of the options as they were refined by the other working groups, due to logistical constraints. The development options, as defined in this report, are those which were identified at the outset of the study. The most important discrepancies are to be found with respect to the exact definition of rail options and the ESIG's failure to address on-site diesel generation as a power supply option during the questionnaire survey.

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EXECUTIVE SUMMARY

1. Present Resource Development

The study area presently contains only a small population (ca. 5,300), despite its considerable area (150,000 km^2). Although potentially valuable natural resources are believed to occur in the area, little baseline inventory information is available. Levels of resource utilization are low, with Native Indians being the primary users (for hunting, fishing, etc.). Without major mineral-based development, this situation will remain largely unaltered, although the regional population could grow to 11,500 by the year 2001.

2. Resource Implications of Major Mine-Related Developments

If major mine-based development proceeds, a widespread increase in resource management tasks and responsibilities is predicted. Based on the development scenario which has been investigated, certain population assumptions have been generated for the Social Overview report, a companion volume to this report. Given the population "medium case" for the social overview studies, it appears that the regional population could reach 22,500 by 2001. The substantially accelerated rate of resource development would bring with it demands on resource managers to meet:

- increased project assessment responsibilities;
- increased regulatory and enforcement responsibilities;
- increased permit processing demands;
- increased data inventory requirements;
- increased capital expenditure requirements; and
- in general, an overall intensification of resource management activity.

At present, very little of the Province's resource management effort is expended in the region. Substantial additional resource management capability would be required in order to cope with the major proposed developments. Fortunately, the Province has adequate lead time to determine how best to cater to future increases in resource management responsibilities.

3. Environmental Overview Impact Assessment

Given the lack of regional inventory information and the highly generalized project proposals, resource managers can do little more than hint at the potential advantages and disadvantages of development proposals at this juncture. Consequently, few options can be categorically endorsed or ruled out at this stage (except possibly the technically very difficult proposed rail link from Sloane to Stewart). The ultimate acceptability of the many development proposals will have to be determined on the basis of more detailed baseline information and more advanced project designs.

4. The Mining Proposals

All of the mining proposals are considered large to very large, and each is capable of considerable environmental impacts unless carefully designed.

5. The Settlement Options

Mining camp options seem generally to be favoured over town development options for all mines, primarily because the camps are much less likely to be associated with major, long-lasting off-site impacts. If town development is selected for the Klappan Coal Project, a townsite south of the minesite is preferred to minimize impacts on Spatsizi Park. Similarly, for the Schaft Creek Copper/Molybdenum Project, the expansion of Bob Quinn Lake is preferred to minimize impacts on Mount Edziza Park. Town development in the Turnagain drainage is not favoured from an environmental impact perspective.

6. The Road Access Proposals

Most of the road access proposals can probably be located along environmentally acceptable alignments within their respective proposed corridors. The More Creek corridor is likely to be preferred for road access to the Schaft Creek mine, even if the valley is eventually flooded by BC Hydro. The Province is currently considering various options for the development of adequate road access between Dease Lake and the Kutcho Creek minesite, since the present track is in very poor condition. This initiative is considered appropriate by resource managers. The pros and cons of road development along the Iskut valley to the Stikine River should also be carefully weighed. Superficially, at least, a road in this valley would have resource development advantages, although not identified as a road access option for the purposes of this study.

7. The Regional Power Supply Options

Either local hydro-electric power schemes or on-site diesel generation are likely to be the environmentally preferred means of bringing power to the various minesites, primarily because of the flexiblity to stage power projects, and also because transmission line development is minimized. The latter considerations are drawbacks of the other major regional power supply options (a link to the integrated grid or development of the Klappan Thermal Power Project). Thermal power supply also raises air quality concerns. The feasibility of proceeding with the More Creek dam without some or all of the other components of the Iskut-Stikine power proposals should be explored with BC Hydro. Assessment of local hydro-electric power supply options is needed for the Sustut mine, since power from the More Creek dam would necessitate a very lengthy transmission line.

8. The Railway Proposals

A rail link from Sloane to Stewart via the Bear Pass could prove to be technically infeasible. Rail links between Groundhog Connection and Terrace and between Sloane and Hazelton would reduce the rail haul distance from the region to Prince Rupert (by about 50%), and would undoubtedly benefit mineral and timber developments. Environmental routing concerns would have to be carefully addressed. Other proposed rail links would not appear to benefit timber or mineral development to the same extent.

9. Resource Management

The prospect of major mine-related development has various important resource management implications, as noted below.

(a) Resource Inventory

Strategic-planning-level data inventories, including 1:250,000-scale biophysical resource mapping, is normally considered an appropriate framework for initial regional resource planning assessments, and the lack of such information in northwestern BC is a source of concern to resource managers. In the longer term, regional-scale (1:50,000 to 1:100,000) resource mapping for areas of potential development would also be required as a preliminary basis for project-specific environmental design, but is presently unavailable. The various options for filling these and other data gaps should be examined. As a prelude, an index of existing resource data, topographic mapping and air photo coverage should be compiled for the region by resource agencies, and the gaps in coverage identified.

(b) Study Area(s)

The northern zone of the Northwest Region is very large, and it would be both logistically and economically desirable to concentrate resource inventory activities in areas where development is most likely to proceed. Based upon the economic feasibility investigations which have formed part of the overall Northwest Economic Development study program to date, it appears that the individual mine options can be priorized on the basis of likely start-up times as follows:

Projected Start-Up Time	Mine	Priority
By 1995	Kutcho Creek Klappan Stikine	High
By 2000	Schaft Creek Eaglehead	Medium
After 2000	Adanac Red Chris Sustut Letain	Low

Initially, study areas could be defined for the three high-priority projects, incorporating all project components (minesite, local settlement site(s) (if any), and all linear development corridors) in each case. The focus of studies could shift to lower-priority projects at a later date, depending on such factors as project scheduling and available study resources.

(c) Resource Management Considerations

As noted above, the Province has adequate lead time to determine how best to cater to any future increases in resource management responsibilities resulting from major mine-based developments. During the next few years, the Provincial Government will be faced with such issues as:

- the relative roles of the public and private sectors in resource management activities such as resource inventory and impact management;
- the setting of strategic resource planning priorities;
- identification of preferred corridors for linear development;
- selection of appropriate review procedures for the various development options;
- allocation of regional gravel resources;
- appropriate measures to manage impacts on wildlife, fisheries, forests, agricultural lands and provincial wilderness parks;
- the involvement of other levels of government and non-governmental parties in development planning and review; and

  in particular, consultations with Native Indian groups on the development of appropriate measures to minimize impacts on their lifestyles.

1. BACKGROUND TO INVESTIGATION

A. NORTHWEST ECONOMIC DEVELOPMENT STUDY

1. In February of 1982, the Cabinet Committee on Economic Development (CCED) initiated a preliminary investigation of the development potential of northwestern B.C. The investigation is jointly sponsored and coordinated by the Ministry of Industry and Small Business Development (MISBD) and the Ministry of Energy, Mines and Petroleum Resources (MEMPR), and involves all relevant provincial Ministries.

2. In May of 1982, a preliminary report to the CCED noted the following points:

   (a) The Study Area has two distinct sectors, a southern sector (south of Stewart), with immediate diversified economic development potential, and a northern zone (north of Stewart), with longer-term potential, based largely on mining. This northern zone is depicted in the accompanying foldout map.

   (b) While small-scale metal mining is active, and will continue to be so, in the northern sector, larger-scale mining, based primarily on copper and coal, would not likely commence before the late 1980's, and only then if certain preconditions were met:

   - early world economic recovery;
   - early recovery and sustained increases in mineral prices and markets;
   - availability of an adequate regional infrastructure, including some of the following components:

     - low-cost power supply;
     - upgrading and extension of the highway system;
     - possible extension of the rail network;
     - possible provision of a commodity pipeline system;
     - expansion of existing ports and/or creation of new ports; and
     - expansion of existing communities and/or creation of new communities; and

   - resolution of social, environmental and trans-boundary issues.

3. Large-scale development north of Stewart would only be possible, given substantial pre-planning by the Province, and a potentially large investment in infrastructure.

4. Based on the range of economic forecasts, an initial basic development scenario was generated for the northern sector (see Appendix C1). (In fact, the latest feasibility investigations have demonstrated that the scheduling of this development scenario was generally too optimistic (e.g. see point IIC #3(d), below)).

5. In any event, in response to the initial (May, 1982) findings, the CCED approved a more detailed, but still highly preliminary, feasibility investigation of the schematic development scenario. The scenario was not considered a firm development proposal, but did provide a focus for what is, in effect, a highly preliminary regional planning exercise.

B. ORGANIZATION OF PRELIMINARY FEASIBILITY INVESTIGATION

1. A committee approach (similar to that used in the early years of the Northeast Coal Study) has been adopted. Six small working groups have been established, and their terms of reference have been approved.

(a) Economic, Financial and Marketing Group

- expected to:
  - refine large-scale production scenarios and confirm their likelihood of realization;
  - estimate associated demands for infrastructure; and
  - evaluate the benefits and costs of alternative means of providing infrastructure.

(b) Mineral Resources Group

- expected to:
  - estimate potential development and production costs of principle potential mining properties in region;
  - refine estimates of mineral output quantities, and of construction and operational labour forces; and
  - analyse world markets for probable trends in mineral prices.

(c) Transportation Group

- expected to:
  - identify a range of possible options for road, rail, pipeline and other transport services at various operating levels;
  - provide preliminary cost estimates for these options; and
  - investigate the need for, and possible costs of, port improvements at Stewart and Prince Rupert.

(d) Municipal Group

- expected to:
  - estimate total regional population growth, based on workforce estimates;
  - identify the range of housing options and their potential costs; and
  - where necessary, initiate preliminary location studies for potential sites for new towns.

(e) Energy Group

- expected to:
  - estimate the potential extent and timing of power demands, based on the development scenarios;
  - identify a range of feasible small-scale and medium-scale hydro-electric and thermal generation and transmission alternatives;
  - estimate the costs of the various generation/transmission alternatives; and
  - investigate the feasibility of private or joint-venture (private/public) power developments.

(f) Environmental and Social Impact Group

- expected to:
  - develop an overview of the impacts of major mine-based development;
  - develop an overview of the impacts of potential infrastructural developments;
  - identify preliminary mitigation needs; and
  - investigate various means of encouraging public participation in the planning process.

2. The six working groups report to an Inter-Ministry Task Force on Northwest Economic Development Opportunities, which includes the working group staff, and which is jointly chaired by MISBD and MEMPR.

3. This Task force reports to the CCED, which includes the following Ministers:

- Minister of Labour (Chairman);
- Minister of Transportation and Highways (Vice-Chairman);
- Minister of Forests (Vice-Chairman);
- Minister of Lands, Parks and Housing;
- Minister of Finance;
- Minister of Municipal Affairs;
- Minister of Industry and Small Business Development;
- Minister of Environment;
- Minister of Agriculture and Food;
- Minister of Energy, Mines and Petroleum Resources; and
- Minister of Tourism.

C. ENVIRONMENTAL AND SOCIAL IMPACT GROUP (ESIG)

1. This working group includes representatives from the Ministries of:

- Energy, Mines and Petroleum Resources (Chairman);
- Environment (Co-Chairman);
- Industry and Small Business Development; and
- Municipal Affairs.

2. Initially, the ESIG has been requested to prepare an overview of the local and regional impacts of the various potential development components which are being considered. The overview was to be based on existing information only, and was to be completed within a few months. No provisions of staff or funds were made for the collection of new baseline data.

3. Given these constraints, the ESIG developed overall terms of reference (see Appendix A), then subdivided its program of work into relatively self-contained environmental and social components. The results of the social overview study are reported in a separate companion document. For the environmental overview study, the ESIG adopted the following basic approach to data collection.

   (a) The ESIG circulated available information on each development component to regional and headquarters (Victoria) offices of the provincial resource Ministries (see Appendix B for contact list).

   (b) This information was accompanied by a detailed two-part questionnaire, which addressed basic questions for each development.

   (c) Analysis has consisted largely of tabulating the questionnaire responses. The text is a summary of the major highlights of the questionnaire survey findings.

4. Individual agencies were asked to respond to the questionnaires primarily with respect to the following resource considerations:

Resource Consideration	Agency(ies)
land status/land management	- Lands (MLPH)
climate	- Waste Management Branch
air quality (waste management)	- Waste Management Branch
soils/terrain/hazards	- Surveys and Resource Mapping Branch
flooding hazard (water management)	- Water Management Branch
avalanche hazard	- Highways (Operational Services)
vegetation	- Surveys and Resource Mapping Branch
mineral resources	- Geological Branch - Inspection & Engineering Branch

petroleum resources	- Petroleum Resources Div.
gravel resources	- Highways (Geotechnical Branch)
water quality (waste management)	- Waste Management Branch (- Water Management Branch)
water quantity (water management)	- Water Management Branch
fisheries resources	- Fish and Wildlife Branch (- Water Management Branch)
wildlife resources	- Fish and Wildlife Branch (- Surveys and Resource Mapping Branch)
agricultural resources	- Agriculture and Food - Forests (Range Division)
timber resources	- Ministry of Forests
recreation/aesthetics	- Parks and Outdoor Recreation Division - Ministry of Forests
heritage resources	- Heritage Conservation Branch

D. NOTE ON DEVELOPMENT OPTIONS

1. Only highly preliminary descriptions of the development proposals were available for the purposes of the environmental overview.

2. Such information as was available is attached as Appendix C to this report.

3. Some refinement of development options has taken place as the other working groups have proceeded with their investigations. However, these refinements were developed too late to be addressed directly as part of the ESIG's program. Hence, there are some minor inconsistencies between this and other working group reports with respect to the definition of development options.

II. SUMMARY OF MAJOR FINDINGS

A. CURRENT STATUS OF RESOURCE MANAGEMENT AND USE

1. Study Area

(a) The study area (which consists of that part of the Northwest Economic Development Region from Stewart northwards) has an area of approximately 150,000 square kilometres (or 55,000 square miles).

(b) This areal extent is approximately four times that of the so-called "Core Area" for the Northeast Coal Development.

(c) Based on 1981 census data, the present population of the study area is approximately 5,300 persons.

2. Provincial and Regional Priority of Resource Base

(a) While many agencies have reported that a "moderate" or "high" priority is placed on the resource base north of Stewart, the region's resource potential is presently extremely under-utilized, which is not unexpected, given the low regional population.

(b) As a reflection of this under-utilization, virtually no agencies, even those which have assigned to the region a high-priority rating, have allocated a comparable priority to resource management program implementation in the area, except in the case of a few obvious local exceptions. Whether judged in terms of the quality of baseline inventory coverage or the staff time and funding assigned to the region, current provincial resource management effort tends to be low to very low.

(c) From the standpoint of its potential, however, the region is highly rated, particularly with respect to its water, air, fish, wildlife, outdoor recreation/aesthetic, mineral and heritage resource endowment.

(d) In general, the timber and range resources of the region are rated marginal by the Ministry of Forests. Except in the Stikine valley around Telegraph Creek, the cropland resources of the region are also rated generally low to very low by the Ministry of Agriculture and Food.

3. Present Resource Use

(a) Although locally significant use is made of mineral, agricultural, recreational and heritage resources, regional levels of use are generally low. Current use of water resources, timber and rangelands is also relatively limited.

(b) Native Indians in the region are prominent among resource users, particularly in their utilization of fish and wildlife resources (as guide/outfitters and trappers). They are also involved to a limited extent in agricultural activity around Telegraph Creek.

(c) Tourism and outdoor recreation opportunities presently attract relatively few individuals from outside the region, and this is reflected in the wilderness objectives which have been adopted for most of the provincial park acreage.

4. Future Prospects Without Major Mine-Related Development

(a) Without major mineral-based development, most resource agencies do not expect rates of resource utilization to increase dramatically over the next 20 years, although a modest growth in tourism and recreation activities is possible.

(b) Other than the proposed mine-related developments, the only other development of sufficient scale to have a significant regional influence appears to be BC Hydro's proposed Iskut-Stikine hydro-electric power project.

(c) This slow-growth prediction is supported by the ESIG's social overview analysis. The base-case population growth projection, given no major government/industry-sponsored mineral development impetus, is one of gradual increase, as in the recent past. Assuming a relatively optimistic 4% annual growth rate (which has actually been sustained during the last few years), the population might reach 8,000 by 1991 and 11,500 by 2001.

5. Present Status of Resource Inventory

(a) Although there are some local exceptions, the environmental data base for the region is generally very weak, particularly when compared to the resource data available for most other parts of the Province. Major resource data deficiencies are noted for:

- land status
- land use
- climate
- air quality
- soils and terrain
- vegetation
- natural hazards (flooding, avalanching, landsliding)
- coal and mineral resources
- sand and gravel resources
- water quality
- hydrology
- fisheries resources

- wildlife resources
- agricultural resources
- outdoor recreation resources
- visual quality (aesthetics)
- heritage resources.

The timber resource inventory is considered generally adequate.

(b) Resource mapping at regional mapping scales (1:50,000 to 1:100,000) is virtually non-existent for most areas.

(c) Some strategic-planning-level (1:250,000-scale) mapping has been completed for terrestrial biophysical and aquatic biophysical systems over a relatively small portion of the study area by the Ministry of Environment.

(d) Probably the most extensive baseline information is available for areas in the vicinity of the proposed Iskut-Stikine hydro-electric power development. However, little of this data coverage can be considered to be other than highly preliminary, despite recent surveys.

(e) In addition to deficiencies in mappable data, inventories based on point-source measurements repeated over time have been found to be highly deficient (i.e. those for climate, air quality, water quality and hydrology). Data for these items are generally stored by means other than mapping.

(f) Resource agencies which normally rely on a sound data base as a necessary prerequisite for meaningful resource management planning (e.gs. the Ministries of Environment, Lands, Parks and Housing, etc.) anticipate a dramatic increase in the internal and external demands for their information during the 1980's, even if the pace of regional economic growth remains slow or, at best, moderate. This has been the experience in other parts of the Province, and the trend is already being noted within the study area.

B. THE DEVELOPMENT PROPOSALS

1. Limitations of Overview Assessment

(a) In attempting to assess the resource management implications (e.gs. the potential environmental impacts, increases in regional resource management responsibilities, etc.) of the Northwest Economic Development proposals, the lack of precise development proposals and, as noted in point A5 (above), a very weak regional baseline inventory were two obvious problems. Moreover, logistical problems were created for questionnaire respondents by the very large number and inherent complexity of the development options (especially the power supply options).

(b) Few (if any) of the numerous development proposals can be judged acceptable or ruled out (on either technical engineering or environmental grounds) as a sole consequence of this environmental overview assessment, although some proposals are open to question.

(c) The assessments of the various linear development proposals are particularly inconclusive since, even when an obvious development constraint is present, more detailed locational analysis may nevertheless produce an acceptable final alignment.

(d) The assessment of settlement options tends to be somewhat more conclusive, probably because the indirect (off-site) impacts of a settlement tend to be of greater concern to resource managers than its direct (on-site) impacts; thus the availability of precise location and design information is not quite so important to the assessment.

(e) The resultant report is highly judgemental, and most reviewers have stressed the need to upgrade the analysis, both through collection of new baseline inventory information and through a more precise definition of development options.

2. The Mine Proposals

(a) The current review procedures for new mines provide a suitable approach to the assessment of each new mining proposal on an individual basis.

(b) However, these guidelines are not, by themselves, sufficient for the generation of a proper regional perspective on the impacts of individual mine projects. This perspective is usually separately generated through appropriate resource planning exercises. Resource planning provides the framework within which the true significance of a project's potential impacts (both beneficial and detrimental) can be assessed.

(c) All of the proposed new mines are large, and may be expected to pose complex impact management challenges. Review agencies have identified the Schaft Creek and Klappan projects as being of especially significant resource management concern, partially because their large production potentials and consequent large workforces make possible the development of new towns. Town developments tend to be accompanied by major indirect impacts, such as dramatically increased levels of natural resource use, which may be very difficult to control.

3. The Settlement Options

(a) Mining camps appear to be more logistically practical for all mining proposals (except possibly the Schaft Creek and Klappan

projects), and are likely to be preferred from an environmental perspective.

(b) If the Klappan project is able to sustain town development, a location south of the minesite, such as McEvoy Flats, is likely to be favoured by resource management agencies in preference to either of the proposed options (Kluayetz and Tsetia), both of which are situated on the border of the Spatsizi Wilderness Park. The McEvoy Flats option should be fully investigated, and its suitability as a living location for the Sustut mine workforce should also be evaluated. It should be conceded, however, that from the perspectives of economic diversification and the quality of life, town location adjacent to the park could be regarded as desirable.

(c) If the Schaft Creek project is able to justify town development, then from an environmental perspective, the Bob Quinn Lake site is likely to be preferred over the other three options (a new town at Mess Lake or expansion of either Telegraph Creek of Kinaskan). These other options pose major environmental problems, primarily associated with encroachment on the wilderness values of Mount Edziza Park and on the varied resource endowment of the Stikine valley. Again, it is conceded that, from an urban suitability perspective, factors such as climate, soils and exposure may tend to favour Telegraph Creek.

(d) Town development in the Turnagain valley is not favoured for a variety of environmental reasons, and may also be logistically impractical, given that the proposal would require the more or less simultaneous development of three or more mines.

(e) It would be worthwhile to consider a coordinated biophysical resource mapping program for potential townsites, covering resource sectors such as soils, terrain, vegetation, aquatic systems and wildlife capability at a detailed scale (e.g. 1:20,000).

4. The Road Proposals

(a) Road development through Mount Edziza Park (and the Raspberry Pass in particular) is not favoured, although there are no other major objections to the expansion of Kinaskan for use by mining workforces.

(b) Although further study is needed, it seems likely that the preferred road access for the Schaft Creek project, from an environmental standpoint, would follow the More corridor, and would link the minesite to Bob Quinn Lake. It will be

necessary to establish whether or not road access can be provided through this corridor if More Creek is dammed and its valley flooded by BC Hydro.

(c) The technical feasibility and environmental acceptability of road access along the Iskut valley from Bob Quinn Lake to the Stikine River appears to be worthy of investigation, given the proposed Stikine mine, the Iskut-Stikine hydro-electric power proposals, mineral exploration at Mount Johnny, and the joint BC-Alaska transportation studies in the Stikine valley. This road access option was not investigated as part of the present study.

(d) The ESIG supports current provincial efforts to examine options for its involvement in resource road construction between Dease Lake and the Kutcho Creek minesite. The present track is in an extremely poor condition. Moreover, improved access to mineral and recreational resources could possibly provide net benefits to the Province in the long term which would outweigh any costs associated with its involvement.

5. The Regional Power Supply Options

(a) Either on-site diesel generation or local hydro-electric power projects, catering to specific local mines, are likely to be preferred over the other two regional power supply options (a major transmission line hook-up to the integrated grid at Telkwa and/or Terrace or thermal power generation from a plant adjacent to the Klappan mine). Both of the preferred power sources are easily staged, thereby minimizing the risk of needless environmental impacts associated with lengthy transmission line development (unlike the other two options). Selection of preferred options, however, has considerable energy efficiency and resource management ramifications, and final decisions should be based on much more thorough analysis.

(b) The Klappan thermal power project raises air quality impact concerns, in addition to necessitating a backbone network of major transmission lines in order to bring power to the region.

(c) Linkage to the integrated grid also requires the advance construction of a lengthy major transmission line network, and is not likely to be supported for that reason. Agencies anticipate that this option could generate a greater increase in resource management workloads than the other options. However, if BC Hydro's Iskut-Stikine hydro-electric power proposals were to proceed, a regional link to the integrated grid would become a reality, whichever option is selected now.

(d) Resource agencies do not regard the four major regional power supply options as necessarily mutually exclusive. There are

numerous permutations of the four basic options, and a more intensive investigation of the power supply question is needed, addressing not only economics, but also energy efficiency and environmental impact.

(e) As part of the local hydro-electric power supply option, a dam on More Creek could possibly be designed in an environmentally acceptable manner. The feasibility of proceeding with the More Creek Dam without some or all of the other components of the Iskut-Stikine power proposals should be explored with BC Hydro.

(f) The More Creek dam would flood what may be the most environmentally favourable corridor for road access to the Schaft Creek mine. Whether or not a road option would be precluded by reservoir development should be determined with the assistance of BC Hydro.

(g) Lengthy transmission lines would traverse environmentally sensitive corridors if the More Creek dam were to serve the Sustut mine. Either on-site diesel generation or a more local hydro-electric power source would likely be preferable (the latter perhaps located in the Toodoggone-Sustut area).

6. The Railway Proposals

(a) Link #5 (Sloane to Stewart) may be technically impracticable. The engineering problems which would be encountered in attempting to develop a rail route through the Bear Pass (such as excessive grades and ubiquitous avalanche problems) may not be amenable to economic engineering solutions.

(b) Links #3 (Groundhog Connection to Terrace) and #4 (Sloane to Hazelton) would dramatically shorten the rail haul distance from the study area to Prince Rupert for the region's mineral and timber exports (with a 50% haul reduction being plausible). Careful environmental engineering would be an essential part of the development of acceptable alignments through the sensitive valley corridor environments which are being considered for these projects.

(c) Links #1 (Dease Lake to Lower Post) and #2 (Dease Lake to Gladys Lake) could probably be located along environmentally acceptable alignments. However, they do not appear to offer the same level of benefits in terms of improved access to known timber and mineral resources as do Links #3 and #4.

C. FUTURE REGIONAL RESOURCE MANAGEMENT NEEDS AND OPTIONS

1. General Considerations

(a) Not surprisingly, most resource agencies anticipate a dramatic

increase in their resource management responsibilities if future regional development is focussed around several more or less simultaneous large mining ventures, possibly (but not necessarily) stimulated by government participation in the provision of a much-upgraded regional infrastructure.

(b) If such an approach to regional economic development is adopted without due consideration given to the implications for resources other than minerals, many resource management options could be inadvertently foregone. Lessons which have been learnt as a result of major resource development elsewhere in the Province, notably in the Northeast Coal Block, if applied in the study area, would serve to facilitate mining development without unnecessarily restricting other resource activities. This statement is particularly true, given the unusually lengthy lead time available before even the first mine would commence production (1987, according to the development scenario under study).

2. Regional Population Growth

(a) The ESIG's social overview studies suggest that the proposed major developments may stimulate a substantial increase in the general rate of population growth.

(b) Based on the development scenario which is under study, and assuming that new resource towns will be developed for the Klappan and Schaft Creek mines, the regional population could rise from 5,300 (the 1981 estimate) to ca. 16,500 by 1991, and to ca. 22,500 by 2001. These figures are approximately double those which are projected if no special mine-based economic impetus is provided, and are derived from the population "medium case" analysis which was generated for the Social Overview report, a companion document to this report.

3. Resource Inventory Needs

(a) The inventory deficiency problem is more formidable in the present study area than it was in the Northeast Coal Block in 1976 (when the Northeast Coal Study was initiated). This is primarily due to the large size of the study area (four times that of the Northeast Coal Block "Core Area"), rather than to the types of data deficiency, which are generally comparable.

(b) One of the major conclusions of this overview assessment is that mapping and other forms of data inventory will be required for the study area to at least a strategic planning level (1:250,000) for all of the basic resource sectors (see point A5(a), above, for a listing).

(c) The problem of study area size could be addressed in part by confining inventory effort to areas where there is a reasonable possibility of major development. Major developments are not presently proposed for many peripheral portions of the study area, and these could be excluded, at least initially, from any concerted inventory effort.

(d) Based upon the economic feasibility investigations which have formed part of the overall Northwest Economic Development study program to date, it appears that the individual mine options can be priorized on the basis of likely start-up times as follows:

Projected Start-up Time	Mine	Priority
By 1995	Kutcho Creek Klappan Stikine	High
By 2000	Schaft Creek Eaglehead	Medium
After 2000	Adanac Red Chris Sustut Letain	Low

(e) Initially, study areas could be defined for the three high-priority projects, incorporating all project components (minesite, local settlement site(s) (if any), and all linear development corridors) in each case. The focus of studies could shift to lower-priority projects at a later date, depending on such factors as project scheduling and available study resources.

(f) In the longer term, even resource mapping at a scale of 1:250,000 will not be adequate for preliminary design work on specific development proposals. Regional-scale inventory (at a scale of 1:50,000) is a basic minimum requirement for most resource sectors if resource data are to be effectively incorporated into project design, even at a conceptual stage of development planning. Moreover, as project design work progresses, correspondingly more detailed environmental data are also required. However, given a reliable regional-scale (1:50,000) data base, it is usually sufficient to confine more detailed data inventory to the immediate project impact zone.

(g) Reasonable topographic mapping and air photo coverage are necessary prerequisites to reliable resource surveys. Both the

existing coverage and the additional coverage requirements should be determined.

(h) If major resource mapping programs are undertaken, substantial provision should be made for logistical and technical support services (e.gs. field coordination, drafting, data plotting, computer analysis, typing, etc.).

(i) Given the above-noted information deficiencies and requirements, the respective roles of the public and private sectors in the collection of baseline data will have to be established during the coming years. Costs of data collection could be substantial, but economies of scale may be possible if data collection is coordinated rather than being undertaken on a piecemeal basis.

4. Long-Term Staffing and Funding Needs

(a) Clearly, the compilation of a regional data inventory would require a short-term allocation of public and/or private funds and manpower. However, in the longer term, the end result of a major development program would be a permanent and substantial increase in the resource management responsibilities of provincial agencies, necessitating a **permanent** boost in the government management resources allocated to the region.

(b) This workload increase would be manifested in numerous ways, including:

- increased project assessment responsibilities (report reviews meetings with developers, etc.) in order to ensure adequate project impact management;

- increased regulatory and enforcement responsibilities (e.gs. with respect to mine inspections, hunting and fishing restrictions, trespass violations, fire prevention, environmental quality monitoring, etc.);

- a dramatically increased permit processing workload, borne at least in part by the regional offices;

- inventory updating from time to time on a case-by-case basis;

- an increase in those resource-related capital expenditures in which the Province presently indulges (such as recreation facility development, resource road construction and maintenance, etc.); and

- in general, an increase in the intensity of resource management effort (this will be reflected in resource management strategy modifications designed to cater to increased levels

of resource use - more hunter days, angler days and camper nights, higher annual allowable timber cuts, more intensive use of Crown lands, etc.).

(c) The relatively minor allocation of staff and funding to resource management programs in the region at present is incompatible with the scope and scale of the proposed mine-based developments. To some extent at least, it may be possible to handle increased workloads by re-focussing the internal priorities of resource management agencies.

5. Specific Issues for Future Consideration

(a) The respective roles of the public and private sectors in development planning and implementation, as they may affect resource management responsibilities, require definition. In any event, the public sector responsibilities are expected to increase if major developments proceed, whatever the allocation of the respective public and private sector duties. Individual agencies will have to determine to what extent the extra workload can be accommodated by internally reallocating existing staff and funding resources. The responsibilities of individual private companies could include several items, such as:

- site-specific baseline data collection within the impact zones of individual projects; and

- management of direct impacts associated with individual projects.

(b) As noted above, a basic minimum requirement for future resource management and planning would be completion of the 1:250,000-scale biophysical inventory for the region. Even this highly preliminary level of mapping coverage is currently only available for selected areas. In the longer term, 1:50,000-scale resource mapping would be required. However, this mapping is much more expensive and time-consuming than the 1:250,000-scale mapping, and could be deferred until the areas of most likely development are better defined. The respective roles of the public and private sectors in data inventory will have to be determined.

(c) At present, there is no comprehensive index of existing baseline resource data. A first step in determining data gaps will be for individual agencies to document in detail the existing data base (and how to access it) for their respective resource sectors in the study area. Such information will be useful to both developers and resource managers.

(d) Strategic resource planning priorities have not been established for most of the surface and subsurface resource base in

northwestern BC. As interest in the region grows, such priorities will emerge through strategic planning activities, and will provide an improved rationale for determining appropriate impact management goals and methods. Preferably, appropriate strategic resource planning activities should occur in advance of the main development thrust.

(e) Given the variety of potential types of development in the region (mines, settlements, linear developments, power generation, etc.), a variety of project review and assessment procedures will likely be utilized. These will perform most efficiently and effectively if they operate within the context of clear development policies for the various components of the Northwest Economic Development (policies for mineral development, settlement, transportation, power supply, the environment, etc.). As tools of impact management, the effectiveness of review procedures will depend on both the quality of available baseline data and the extent to which strategic resource planning and development priorities have been defined in advance (see item (d), above).

(f) Experience elsewhere in the Province has shown that uncoordindinated linear development leads to right-of-way duplication, and consequently, to needless impacts on surface resources. Given the plethora of potential linear developments in northwestern BC, public and private sector cooperation will be needed to avoid this problem.

(g) Gravel resources are believed to be scarce in many parts of the region. Problems will be encountered in meeting the disparate gravel needs of several loosely related or unrelated developments with unpredictable timeframes.

(h) Wildlife values in portions of the development area are among the highest in the Province, and sustain significant and increasing use (both consumptive and non-consumptive). Significant wildlife impacts are expected to stem from the proposed developments. These impacts may affect the livelihoods of the numerous local trappers (many of them Native Indians), and also the livelihoods of those engaged in big-game hunting (e.gs. motel operators, aircraft charter companies, guide/outfitters and other service industries). At present, baseline wildlife data are scarce. Future issues include inventory deficiencies and impact management and enforcement needs.

(i) Development could affect all of the major drainages of the study area, and notably the Stikine, Iskut, Nass, Skeena and Klappan drainages, which sustain important salmon fisheries. These salmon fisheries contribute a significant proportion of

the Province's overall salmon production. Moreover, other attractive game fish are prominent in many streams. Much of the jurisdiction over salmon stocks rests with Fisheries and Oceans Canada, and both federal and provincial agencies will be involved in future fisheries impact management activities as development planning progresses. Native Indians rely heavily on the regional fisheries, and will have a major interest in development proposals which affect fisheries. Future issues include inventory deficiencies, impact management and enforcement needs.

(j) Agricultural values are generally low to very low in the region, except along the Stikine valley between Telegraph Creek and Glenora, the only major area of current agricultural activity. The Ministry of Agriculture and Food is keen to ensure that encroachment of new development on these agricultural lands is minimized.

(k) As noted above (see points B#2 and #3), the Parks and Outdoor Recreation Division is concerned over the potential impacts of proposed mine-related developments on park values in two of its major wilderness parks - the Mount Edziza and Spatsizi Parks. The Division will be placing a high priority on minimizing the impacts of the Schaft Creek and Klappan projects respectively on these two parks. Potential wildlife and heritage resource impacts are also of concern in the two parks. Consideration may have to be given to a more intensive level of park management.

(l) As noted in several earlier points, most types of major development are likely to affect the hunting and fishing activities of the local guide/outfitters and trappers (most of whom are Native Indians), and will, in a more general sense, affect current Native Indian lifestyles in the region. Native Indian concerns will feature prominently in development planning. It is known that Native Indian groups wish to be involved in the planning process for Northwest Economic Development, and that they will expect detailed consultations with both government agencies and private developers.

(m) Some coordination of resource management activities (including inventory, studies, project assessments, permitting, enforcement activities, etc.) would help to increase the efficiency and effectiveness of development planning. Several types of coordinating approaches could be considered by government and private sector participants in the development.

III. SUMMARY OF FINDINGS BY DEVELOPMENT PROPOSAL

A. RAILWAY CORRIDOR OPTIONS

1. General

(a) Baseline inventory is deficient for most resource sectors, although some preliminary observations are possible, based on the professional judgements of regional staff. If any or all of the five rail corridors are pursued further in the future, it will be necessary to implement detailed baseline inventories before reliable impact assessments can be undertaken.

(b) Links #3 and #4 would dramatically shorten the rail haul distance from the study area to Prince Rupert, thereby benefitting the region's mineral and timber exports. Links #1 and #2 do not appear to offer the same level of benefits in terms of improved access to known timber and mineral resources.

(c) For some rail corridors, specific corridor relocations are recommended to avoid engineering problems and/or to reduce environmental impacts.

(d) The technical feasibility of rail access through the Bear Pass (Link #5) is open to question, given steep terrain and a severe avalanching problem.

(e) The other four links appear to be technically feasible, although posing various environmental problems.

2. Link 1 - Dease Lake to Lower Post

(a) Construction problems will be encountered where the route passes through zones of permafrost and lacustrine sediments.

(b) The route, depending on its exact alignment, could conflict with Crown land leaseholders at Dease Lake, and with BC Hydro's flooding reserve along the Liard River.

(c) There would be conflicts with fisheries, wildlife and heritage values in the Dease valley, and with scenic values along Highway #37.

(d) The Ministry of Forests anticipates the potential loss of productive forest lands, and suggests that a realignment along the Eagle and Dease valleys might have less impact, although other agencies would prefer that the route avoid the Dease valley (see item (c), above).

3. Link 2 - Dease Lake to Gladys Lake

(a) Detailed alignment possibilities are numerous, and a route along the Sheslay and Inklin valleys to Atlin Lake may be worthy of consideration. This route is considerably to the southwest of the Gladys/Kawdy corridor.

(b) Deficiencies in baseline information should be noted, particularly in mapsheets 104/N and 104/O, which cover northern portions of this corridor.

(c) Lacustrine soils, suspected permafrost zones and gravel shortages are expected to pose technical difficulties, although precise information is lacking for northern portions of the corridor. Road development might pose fewer engineering and environmental problems than rail development.

(d) It is very difficult to predict potential levels of environmental impact, even in a preliminary manner, due to a general absence of baseline resource information, especially in northern portions of the corridor.

(e) Wildlife impact concerns are noted. Moose and caribou winter ranges would be traversed, resulting in consequent wildlife collision mortality problems.

4. Link 3 - Groundhog Connection to Terrace

(a) Baseline information is more readily available for this corridor than for Links #1 and #2.

(b) Partially reflecting this greater knowledge, a larger number of anticipated concerns have been raised, and this has led to several corridor realignment proposals, such as:

- use of the Highway #37 corridor from Meziadin southwards to join the CNR at Kitwanga rather than at Terrace (may reduce losses of forest land); and

- in northern portions of the corridor, links between the Nass and upper Skeena valleys via either the Damdochax, Panorama and Currier valleys, or the Anthony and Biernes valleys, possibly involving some tunnelling, but in both cases avoiding difficult terrain.

(c) Technical difficulties with route construction are anticipated, although detailed baseline information is generally lacking. Snow removal is likely to be a problem, and terrain conditions in the mountains will impose major technical constraints on rail development.

(d) Numerous fisheries streams are crossed, and crossings would

have to be carefully engineered. Wildlife collision problems are likely across moose winter ranges. Agricultural values could be impacted in southern portions of the corridor. The route could be highly detrimental to recreational values in the proposed Aiyansh Lava Park. New timber harvesting areas may be accessed, which would largely offset losses of forest lands.

5. Link 4 - Sloane to Hazelton

(a) Baseline information is more readily available than for links #1 and #2, although there are notable deficiencies.

(b) Some agencies feel that this corridor (or a close approximation to it) should form the basis for any shortcut from the BCR track to the CNR track. In principle, such a corridor is known to be of interest to the proponents of the Klappan Coal Project (a proposal of Gulf Canada Resources Inc.).

(c) Technical difficulties with route construction are anticipated, although available terrain/soils information is minimal. Snow removal is likely to be a major maintenance task.

(d) Numerous fisheries streams are crossed, and crossings would have to be carefully engineered. Wildlife data are deficient, especially in mapsheet 94/D. Agricultural values could be impacted in southern portions of the corridor. Heritage sites are potentially numerous, and should be avoided or salvaged. New timber harvesting areas would be accessed.

6. Link 5 - Sloane to Stewart

(a) Baseline information is more readily available than for links #1 and #2, but important deficiencies remain.

(b) Major technical difficulties with route construction and operation are anticipated, due to difficult terrain, avalanching, and heavy snowfalls, both in the Bear Pass and elsewhere along the corridor.

(c) In fact, the Bear Pass section may be technically impractical, and it might be more worthwhile to consider a link southwards from Meziadin to Hastings Arm or Alice Arm (e.g. to Kitsault).

(d) Important fisheries streams and low-to-moderate-capability moose winter range would be crossed. New timber harvesting areas may be accessed.

B. REGIONAL ELECTRICAL SUPPLY OPTIONS

1. General

(a) Evaluations have been hampered by incomplete inventory information, but, based on available data, there appears to be

no unanimous preference, largely reflecting doubt about the future of the Iskut-Stikine project.

(b) If there is to be eventual hydro-electric development of the Iskut-Stikine system, some form of option A (supply from the integrated grid) is logical, since a long-term link to the integrated grid would form part of the overall development.

(c) However, given the doubt about the future of the Iskut-Stikine project, many agencies have cited option B (local hydro-electric development) as their preference. It is the most flexible (most easily staged) approach, it accommodates the reality of largely unpredictable mine startup times, and minimizes the risk of unnecessary transmission line development. It will be necessary to verify with BC Hydro whether or not the More Creek dam could be constructed economically without some or all of the other components of the Iskut-Stikine project.

(d) Although not included as an option for the purposes of the ESIG's study program, on-site diesel generation would also be acceptable to most agencies because it provides maximum flexibility, while minimizing environmental impacts. This option is addressed in the final report of the Energy Group, but was not identified at the outset of studies.

(e) Option A is the least flexible (least easily staged) approach, requiring a commitment to the construction of a considerable length of transmission line prior to the startup of the first mine. The impacts associated with thousands of kilometres of transmission line would not be considered worthwhile for only one or two mines (if the others do not proceed).

(f) Option C (thermal power generation) tends not to be favoured because of unpredictable air emissions impacts, in addition to problems with inherent inflexibility in the staging of transmission line construction. Thermal power supply from the Telkwa coalfield, which was suggested by one agency, suffers from the same drawbacks as options A and C.

(g) It is obvious that there are numerous possible permutations of the four basic power supply options (if diesel generation is included), and a much more elaborate approach to regional power supply planning, which takes into account the various possible combinations of options A, B and C, should be commissioned. The study should attempt to balance the potential economic and environmental advantages and disadvantages of systems which can be more or less staged, compared with those which cannot, but which may be more cost-effective in the long term, providing that several (or all) proposed mines eventually proceed. On-site diesel generation should be included in the study as a fourth basic power supply option, and the ESIG notes that the Energy Group has addressed the option in its final report.

2. Power Supply From Integrated Grid (Option A)

(a) This option is not generally favoured because a very lengthy transmission line network must be in place before the first mine can be supplied; hence, the system is relatively inflexible, and does not lend itself to staged construction as readily as do either options B or C.

(b) It might be the most logical option if a regional link to the integrated grid was needed as part of the overall Iskut-Stikine project. However, the latter would itself be unpopular from an environmental standpoint because of both the widespread flooding of valley-bottom resources and the considerable length of transmission line development.

(c) Option A is likely to involve a greater increase in the resource management responsibilities of agencies (inventory, staffing, enforcement, etc.) than options B or C in most cases.

(d) Link #1 (Telkwa to Meziadin, 500 kV) crosses regions for which some inventory data already exist. Some impact on fisheries, agriculture, forestry, recreation and heritage resources must be expected. In the Telkwa area, there may be conflicts with private landowners and agricultural leaseholders.

(e) Link #2 (Terrace to Meziadin, 500 kV) crosses fairly rugged terrain which features a severe winter icing problem plus high winds. It is expected that fisheries, forestry and agricultural resources (including agricultural leaseholdings in the Terrace area) will be affected. Baseline data are not available for heritage and recreation resources.

(f) Link #3 (Meziadin to Bob Quinn Lake, 500 kV) has been less thoroughly inventoried than links #1 and #2. Fisheries and scenic values will likely be impacted. More detailed baseline information is needed for most resource sectors (fisheries, wildlife, recreation, heritage resources). Winter icing and high winds will pose technical problems.

(g) Link #4 (Bob Quinn Lake to Stikine Z switching substation, 500 kV) lacks inventory data for almost all resource sectors. Terrain problems are anticipated in the Iskut valley. Visual impacts will affect recreational use of Highway #37.

3. Local Hydro-Electric Power Supply (Option B)

(a) This option is preferred by most agencies, particularly since the Iskut-Stikine power project will not likely proceed sufficiently soon to coincide with the Development Scenario under study. Option B can be staged, and is therefore most compatible with the uncertainties surrounding the start-up times of the proposed mines. This option is not necessarily preferable to fisheries biologists, however, since, in the long

term, the additive impacts of this option plus eventual implementation of the full Iskut-Stikine development would be severe.

(b) There is some doubt regarding whether or not the More Creek dam can be economically developed, other than as part of the overall Iskut-Stikine development. If it cannot, most agencies would likely want to reconsider their relatively favourable view of the More Creek dam proposals. This matter should be explored further with BC Hydro on a high priority basis.

(c) A few agencies suggested that, if sufficient power could be generated, the More Creek dam might be developed to supply mines other than those suggested for this study (e.g. Red Chris). This strategy could have the disadvantage of a lengthy transmission line network, but warrants further consideration. By contrast, the Sustut minesite is distant from the More Creek dam, and consideration should be given to a small hydro-electric development in the Sustut-Toodoggone area to minimize transmission line development.

(d) If the More Creek dam were developed, the most severe environmental impacts would be incurred by the high-value fisheries along the lower Iskut River, where discharge and sediment level changes would be experienced. The reservoir might also interfere with the option to provide road access to the Schaft Creek minesite through the More valley, an option which is favoured for this mine by several agencies.

(e) The Turnagain Dam would have impacts on many resources (such as fisheries and heritage resources), but further inventory is needed to establish these impacts for most resource sectors. There should be further examination of the possibility that this dam, together with the More Creek dam, would be sufficient to meet the needs of all of the proposed new mines.

(f) The Eaglenest Creek dam could affect the location of the unfinished BCR grade, and also the western margins of Spatsizi Park. Heritage and wildlife resource impacts are also expected. Virtually nothing is known about the fisheries values which might be affected.

(g) The Unnamed Creek dam (proposed for the Red Chris mine) could affect the location of the Tsetia townsite. Very little inventory information is available to judge fisheries, wildlife, recreation and other resource impacts resulting from this dam.

(h) For all of the dam proposals, it may be possible to implement fisheries enhancement projects in order to mitigate fisheries impacts, primarily by means of barrier removal, although consideration could also be given to fish hatchery development, fish ladders and restocking programs. However, no mitigation is likely to offset the losses of fur-bearers and big-game

animals effectively. Specific guide/outfitters, registered trapline holders and Native populations could be seriously affected. A major allocation of Fish and Wildlife Branch effort will be required at the planning, construction and operations phases for studies, enforcement activities and management programs if hydro-electric power projects proceed in the region.

4. Klappan Thermal Power Project (Option C)

(a) This option is not favoured from an environmental standpoint. Compared to option A, it has the advantage of a shorter (but still lengthy) transmission line network. Moreover, its development could be staged somewhat, although not to the same extent as for option B. However, the potential air emissions and their impacts on surface resources are major unknowns which are of concern to several Ministries.

(b) In the vicinity of the Klappan minesite, where a thermal power plant would likely be located, air dispersion potential is believed to be good. However, air pollution and acid precipitation concerns are noted for fisheries, agricultural, wildlife and recreational resources.

(c) Use of the Tumeka-Highway #37 corridor (corridor C1) for trunk transmission line development seems generally to be preferred over the Tumeka-Klappan-Highway #37 corridor (corridor C2). Most of the agencies which stated a preference were keen to avoid unnecessary development of the Klappan valley in order to preserve fisheries, forestry and heritage resource values. Terrain conditions in corridor C1 are believed to be more favourable to transmission line construction than those in corridor C2. Recreation and wildlife data are lacking, and should be collected if project planning proceeds further.

C. MINE GROUP I - SUSTUT COPPER PROJECT

1. Minesite

(a) Although climatic information is deficient, severe winter conditions are expected at the minesite.

(b) High fisheries values are reported in adjacent streams.

(c) Information deficiencies are reported for most resource sectors.

2. Settlement Options

(a) In general, a camp option is acceptable for this mine, although fisheries, wildlife and heritage values will require protection. Environmental impact data are scarce.

(b) Livability information is also scarce, but it is anticipated that climatic conditions would be severe for a mining camp. The local terrain is rather difficult, and some avalanching is reported near the minesite.

(c) Possible camp locations should be sought upwind of the mine, perhaps in the Moose valley or in the Sustut valley upstream of the Moose valley.

(d) If the McEvoy Flats location is seriously considered as a townsite for the Klappan Coal Project, the feasibility of housing the Sustut mine workers here should be investigated, although the long commuting distance may be economically prohibitive.

(e) Detailed studies of environmental impact and urban suitability will be required in order to locate an acceptable campsite (or townsite, if that option is eventually considered).

3. Road Access

(a) Only the Birdflat-BCR-Nilkitkwa corridor was examined. It is believed that such a road could benefit mineral, timber and recreation activities.

(b) Environmental impact information is scarce, but fisheries concerns have been cited.

(c) This corridor appears to be preferred to any attempts to access the mine from the Omineca-Peace region, but the possibility of following the BCR track instead of the Nilkitkwa corridor to minimize needless provision of access is suggested by one agency (the Ministry of Forests).

4. Transmission Line Corridors

(a) Without more detailed baseline information, it is not possible to select a clear preference from among the four transmission corridor options which have been proposed - A1 (Nass-Skeena-Mosque), A2 (Nass-Stephen-BCR-Sustut), A3(B1) (Highway #37-Tumeka-Skeena-Mosque) and C1 (Skeena-Mosque).

(b) Fisheries impact potential will be of general concern for all stream crossings, and is specifically noted for corridors A1 (crossings of Damdochax Cr., Kwinageese R., Nass R., Skeena R.), A2 (Sustut R., Skeena R., Nass R., Slamgeesh R.) and C1 (Skeena R., Kluatantan R.). However, detailed fisheries inventory data are lacking for many of these streams.

(c) Icing and high winds are expected to pose particular problems in corridor A3(B1). Climatic information is lacking for the local area.

(d) Information is inadequate or entirely lacking for soils/terrain, recreation/aesthetics, heritage resources, wildlife, vegetation, water resources and structural materials (although some mineral potential data are available).

(e) Based on agency review comments, none of the four corridors should be eliminated from consideration at this stage. Either corridor A1 or A2 would be the least technically difficult, given terrain conditions. Corridor A3 has some agency support since it provides a direct link between the BCR track and Highway #37, avoids the Nass, Stephen and Sustut valleys, and has apparent recreation resource advantages.

5. Resource Management Implications

(a) Data deficiencies are reported for almost all resource sectors.

(b) The need for increases in management effort is foreseen by many agencies (Lands, Mines, Forests, Environment, Heritage) if the mining project proceeds.

D. MINE GROUP II - KLAPPAN COAL PROJECT

1. Minesite

(a) Although data deficiencies are reported, notably for fisheries, forestry and heritage resources, some preliminary projection of potential impacts is possible.

(b) Difficult mountain terrain and severe winter climatic conditions will be encountered at this minesite. Coal particulates will likely affect air quality locally.

(c) Recreation and wildlife resource impacts may be expected along the southwestern margins of the Spatsizi Wilderness Park. Specific concern has been expressed for possible impacts on the subalpine meadows along Kluayetz Creek and the upper Spatsizi River, on scenic values in the park and in the Kluayetz and Little Klappan valleys, and on wildlife values (post-calving caribou habitat, and habitat for other ungulates, grizzly bear and black bear).

(d) The Parks and Outdoor Recreation Division anticipates an increased management workload either to protect park wilderness values or to provide more intensive park use opportunities.

2. Settlement Options

(a) Both the Kluayetz and Tsetia townsites pose serious environmental problems. The former is less problematical because it would cause fewer access complications. It could be accessed via the Skeena corridor, thereby materially reducing exposure of the southwestern margins of Spatsizi Park to development.

(b) The Kluayetz townsite is favoured from the standpoint of urban suitability (soils/terrain, water supply, aspect, proximity to scenic areas), although hazardous terrain (floodplains, steep slopes, avalanche zones) would have to be avoided. However, the townsite would seriously affect wilderness values (fisheries, wildlife, guides and trappers, aesthetics, etc.) in the neighbouring park. A substantial increase in park management effort would be needed. Close proximity to the minesite could result in air quality problems for this townsite.

(c) The Tsetia townsite is also favoured from an urban suitability standpoint, largely for similar reasons to those cited for the Kluayetz townsite; and its climate is more favourable than that of the latter (warmer, less exposure, less snowfall, etc.). However, its environmental impacts would be more severe, causing greater exposure of the park to development, given the need for road access through the difficult terrain of the Little Klappan valley (which parallels the park's southwestern boundary).

(d) If a camp were selected rather than a townsite, a location in the vicinity of the Kluayetz townsite appears to be logical.

(e) There is now some interest in identifying possible townsite locations to the south of the minesite in order to reduce encroachment on Spatsizi Park. The McEvoy Flats site is of particular interest since it is more central to the Groundhog Coalfield, could develop into a natural transportation hub, could serve local logging operations, and could conceivably house the Sustut mine workforce.

(f) If townsite options are to be seriously considered for the Klappan mine, a more detailed environmental and urban suitability site analysis will be necessary.

3. Road Access

(a) One option (the Skeena-Nass corridor) was examined.

(b) This option would be beneficial for mineral and timber development, but would be beset by difficult terrain and severe winter climatic conditions.

(c) Fisheries impacts are anticipated at crossings of the Skeena, Nass, Kwinageese and Hanna drainages. The fishery values of the Klappan drainage are largely unknown.

(d) Knowledge of wildlife and heritage resources is scarce. However, these plus recreation resources will certainly incur impacts as a result of increased park access and use levels, and there will be a consequent need for increased management effort.

(e) Alternative corridors which may be worth detailed consideration are:

- the Nass-Panorama-Currier-Skeena corridor; and

- the Nass-Anthony-Biernes-Skeena corridor.

4. Pipeline Corridor

(a) One corridor (the Skeena-Nass-Bear corridor) was examined, based on the assumption that coal would be shipped from Stewart.

(b) Disposal of waste water at Stewart would pose a major environmental problem. Mitigation of impacts on anadromous fisheries at stream crossings would be essential.

(c) Recreation/aesthetic impacts are likely in the Bear corridor.

(d) Information is lacking on the development suitability of this corridor proposal, but the Bear Pass is known to feature severe terrain and extensive avalanching.

(e) Private land acquisition would be necessary in the Stewart area.

5. Transmission Line Corridors

(a) Only one transmission corridor was examined - Highway #37-Tumeka (corridor A1(B1)).

(b) Development suitability of the corridor is inhibited by difficult terrain and severe winter weather (icing, high winds).

(c) Although information is lacking, it is not expected that a transmission line in this corridor would have major impacts on mineral, forestry, recreation or ungulate values. Virtually nothing is known of fisheries and heritage values.

6. Resource Management Implications

(a) As elsewhere in the study area, serious data deficiencies have hampered this preliminary assessment. For some or all of the project's components, data deficiencies are reported for soils/terrain, agricultural capability, wildlife and aquatic resources (especially in the Little Klappan valley), climate and air quality.

(b) A coal mine which might eventually produce 5 million tonnes of anthracite per year will stretch the resources of several Ministries, most notably those of the Ministries of Environment, Forests, Lands, Parks and Housing and Energy, Mines and Petroleum Resources.

(c) The Parks and Outdoor Recreation Division has estimated that a dramatic change in the management strategy for the Spatsizi Wilderness Park would be necessitated.

(d) In general, the environmental impact potential of this project is considerable, and will pose major impact management challenges. The ability to completely mitigate some of the potential impacts is in doubt, particularly those impacts incurred by mountain caribou and park values.

E. MINE GROUP III - EAGLEHEAD, LETAIN AND KUTCHO CREEK PROJECTS

1. Minesites

(i) General

(a) Information is generally lacking for the upper Turnagain drainage and surrounding areas, and particularly for recreation and heritage resources and soils/terrain conditions.

(b) In general, the Turnagain drainage supports important fisheries values and contains moderate habitat for mountain caribou, moose and grizzly bear. These values will be impacted if one, two or three mines are developed.

(ii) Eaglehead Copper/Molybdenum Project

(a) Difficult soils/terrain conditions (severe erosion problems in particular) will be encountered in the vicinity of the minesite.

(b) Detailed development suitability information, however, is not available for this area.

(c) Important fisheries values in the area may be affected by mine development. Significant fisheries are reported in the Eagle and Turnagain Rivers, in Eaglehead Lake, and in small lakes southwest of the latter. Moderate caribou, moose and grizzly bear habitat may also be affected, as will recreation values associated with Eaglehead and Cry Lakes. Guide and outfitter activity may be affected locally.

(iii) Letain Asbestos Project

(a) Very little development suitability information is available, although both soil erosion and snow avalanche problems are expected.

(b) Impacts may be incurred by the significant fisheries of the Letain Lake/Letain Creek system, the Blick Creek/Wolverine Lake system, and the Kutcho Creek system. Mountain caribou, moose and summer grizzly bear habitat occurs within the local area, and local guide and outfitter activity may be reduced.

(iv) Kutcho Creek Copper/Zinc/Silver Project

(a) Very little local development suitability information is available. Severe soil erosion problems are believed likely.

(b) Impacts may be incurred by significant fisheries in the Andrea Creek and Kutcho Creek drainages. Summer moose, mountain caribou and grizzly bear habitat occurs locally, and the activities of guides and outfitters may be locally inhibited.

2. Settlement Options

(a) From a strictly environmental perspective, the preferred settlement option would likely be to locate a camp at each minesite. However, further analysis of the other options (a new town - the Turnagain option - or expansion of Dease Lake) is warranted, given the paucity of baseline data in the local region. Data are notably lacking for wildlife, agriculture, timber and recreational resources.

(b) The Turnagain townsite has several positive features from the standpoint of urban suitability (e.gs. attractive natural setting, and fishing, hunting, canoeing and skiing opportunities), although there are also a few potentially negative considerations (e.gs. possible close proximity to one or more minesites, difficult and hazardous terrain, predatory bear problems). In terms of environmental impact, potential problems include dramatically improved access to a presently inaccessible area, destabilization of the sand dune terrain around Turnagain Lake, conflicts with placer and mineral claims, disruption of alpine meadows, and conflicts with fisheries and wildlife values.

(c) If the Turnagain townsite is considered in the future, possible specific locations for the town may be suggested:

- the northern side of the Turnagain River;

- the southern side of the Turnagain River, Flat and Ferry Creeks; and

- between Flat and Ferry Creeks.

(d) Expansion of Dease Lake would raise few urban suitability problems, providing that the shoreline of Dease Lake and the Tanzilla River valley bottom can be avoided. Environmental impacts on heritage and wildlife resources and also on the fisheries of Dease Lake and the tributaries of the Stikine River may be of concern. However, this settlement option is environmentally preferable to new town development in the Turnagain valley.

(e) Although environmental problems associated with the mining camp option would be similar in nature to those for the Turnagain townsite, they would be less severe. For the Eaglehead camp, siting should avoid avalanche zones in the Hard Creek valley. The Letain camp should avoid mountainous terrain around King Mountain, and should be sited to avoid fugitive dust from the minesite. The Kutcho Creek camp should avoid the avalanche zone on the eastern slopes between the two small lakes.

(f) Access development between the minesites and Highway #37 at Dease Lake is likely to lead to major environmental problems, irrespective of the settlement option which is selected (see below, point #3). Impacts on fisheries, wildlife and alpine meadows are anticipated along the road corridor.

3. Road Access

(a) One option (the Letain/Turnagain corridor) was examined.

(b) The current track between Dease Lake and the Kutcho Creek exploration site is in a very poor condition, and has been associated with environmental problems for some years. Upgrading of this road would be beneficial in improving access to mineral and recreational resources. Given that improved road access might benefit more than one mining venture, provincial involvement in road upgrading is being considered. It should be noted that few forest values would be accessed.

(c) The corridor is known to be subject to deep snow drifting, which may restrict winter access unless adequate winter maintenance is undertaken. Environmental concerns include protection of fisheries values (in the Turnagain River and Kutcho, Letain and Cariboo Creeks) and encroachment on both moderate-capability summer ungulate habitat and some attractive alpine units.

(d) Although not specifically examined, a road corridor following either the McBride valley or the Kehlechoa valley would likely not be generally favoured, in view of the proximity of either corridor to the northern border of Spatsizi Park. Either corridor would also involve lengthier road construction than the Letain/Turnagain corridor. However, given the potential environmental problems, a corridor north of the Letain/Turnagain corridor might be environmentally preferable, and some further study is advised.

4. Transmission Line Corridors

(a) Without more detailed baseline information, it is not possible to select a clear preference from among the three transmission corridor options which are proposed - A1(C1) (Highway #37-Letain/Turnagain), A2(C2) (McBride) and B1 (Kutcho/Turnagain-Letain/Turnagain).

(b) Corridor A1(C1) could necessitate crossings of several streams with high fisheries values (the Turnagain River and Kutcho, Letain and Cariboo Creeks), as could corridor B1 (Turnagain River and Kutcho Creek). Fisheries knowledge is deficient along corridor A2(C2).

(c) High visual impacts, heritage resource impacts (in the lower Dease valley) and loss of wilderness values are potential problems along corridor A1(C1). Recreational and scenic values along the Stikine River could be affected by corridor A2(C2). The recreational and aesthetic implications of corridor B1 are not known, although wilderness values would presumably be affected.

(d) Provincial resource agencies have widely differing opinions on the preferred corridor, and a final decision should be based on further studies of the options as well as the final choice of a regional power supply option. Corridor A1(C1) could be serviced from the access road (MEMPR, MLPH), and would be favoured if a major transmission line already existed in the Highway #37 corridor (Forests). If no major transmission line is built, corridor B1 is preferred (Forests), and would also appear likely to cause the least visual impact (PORD). There is no agreement on the corridor which poses the least technical construction problems.

5. Resource Management Implications

(a) As elsewhere in the study area, serious data deficiencies are noted for almost all resource sectors from some or all project components. Specific mention is made of deficiencies in soils/terrain, mineral, fisheries, agricultural, climatic, recreational, heritage and wildlife data.

(b) The indirect impacts of mining development will include major improvements in local access, and a consequent need for more intensive management of fish, wildlife, recreational and other resources (e.gs. greater enforcement of regulations, provision of more recreation facilities, etc.).

(c) If the access road from Dease Lake were to become a public road, winter maintenance costs would be incurred by the Province.

F. MINE GROUP IV - RED CHRIS, SCHAFT CREEK AND STIKINE PROJECTS

FI. - RED CHRIS COPPER PROJECT

1. Minesite

(a) Information deficiencies are noted for most resource sectors.

(b) With respect to development suitability, severe winter climatic conditions (high winds and deep snows) are anticipated. Virtually no soils/terrain information is available.

(c) Fisheries, recreation and heritage resource information is lacking. Based on preliminary wildlife information, it appears that important mountain goat and Stone's sheep ranges could be affected.

2. Settlement Options

(a) Existing environmental information forms an insufficient basis for a concrete recommendation on the preferred settlement option.

(b) The camp option has some appeal, given the local aesthetic setting. However, development constraints are likely to include difficult foundation conditions (shallow soils), severe winter weather, and fugitive dust from the mine. The local wilderness values would be impacted, as would the mountain goat and Stone's sheep habitat to the southwest of the minesite. One possible camp location is the low-elevation valley northeast of Kluea Lake.

(c) Expansion of Kinaskan for the mine workforce poses few environmental problems. Development suitability factors are positive - suitable soils/terrain conditions, southern exposure, good views, and lake-based recreation, hunting and hiking possibilities. No major impact concerns are noted at this time.

(d) Expansion of Iskut/Eddontenajon likewise poses few environmental problems. Sufficient land is available for expansion, and the nearby hazardous avalanche, floodplain and lakeshore zones can be avoided. The site is attractive with respect to views, aspect and water-based recreation opportunities. Potential impacts, including those on the lake, can probably be satisfactorily mitigated.

3. Road Access

(a) One option - the Coyote corridor - was examined.

(b) Road construction could be difficult, due to the propensity of the local siltstone bedrock for failures and surface erosion. Detailed terrain/soils information is lacking. Deep winter snows, and a consequent winter maintenance problem, are anticipated.

(c) The new road may provide benefits in terms of improved access to wilderness and forest recreation areas, and to potential timber harvesting areas. Potential impacts on the fisheries of Ealue Lake and Coyote Creek are foreseen.

(d) Some agencies feel that the access road and transmission line corridor should be combined, and that transmission corridor A1(C1) - the Highway #37 corridor - should be considered for both developments.

4. Transmission Line Corridors

(a) Without more detailed baseline information, it is not possible to select a clear preference from among the three transmission corridor options which are proposed - A1(C1) (Highway #37), B1 (Little Klappan) and C2 (Highway #37, Alternative).

(b) Corridor A1(C1) could involve difficult construction conditions in the siltstone bedrock. Impacts on scenic values along Highway #37 are anticipated. Information on fisheries, wildlife and heritage resources is insufficient.

(c) Very little is known about corridor B1, particularly with respect to fisheries, wildlife, heritage and recreation resources.

(d) As for corridor B1, information for key resources within corridor C2 is insufficient. The Klappan River system is known to be used by commercial rafting interests.

(e) Opinions differ as to which corridor is preferred. Corridor A1(C1) is considered the least technically problematical from the standpoint of climate, minerals, fisheries and timber resources, and could also accommodate the road access (in preference to the Coyote corridor). Corridor B1 would have less visual impact than corridor A1(C1), and is a shorter option. Option C2 would involve a very short spur from a 230-kV line. Depending on the location of the latter, which might itself make use of the BCR grade, thereby minimizing new right-of-way development, this option may be acceptable.

5. Resource Management Implications

(a) Detailed aquatic inventories are required for that part of the Stikine River basin to the east of Highway #37, and in particular along all potential linear corridors. Detailed inventory is also required for recreation and heritage resources, and for land status.

(b) Some increase in the resource management responsibilities of various agencies is foreseen (increased inventory, enforcement and regulation, etc.).

FII. - SCHAFT CREEK COPPER/MOLYBDENUM PROJECT

1. Minesite

(a) Development suitability information is generally lacking, although high winter snowfalls can be expected.

(b) Impacts on agriculture in the Stikine valley would be minimal. Considerable concern has been expressed over possible project impacts on the wilderness values of Mount Edziza Park.

(c) Detailed inventories of fisheries resources are required (except for the mainstem Stikine River). More data are also required for wildlife, heritage resources and terrain/soils. At present, it is not possible to provide a reliable preliminary assessment of minesite impacts.

2. Settlement Options

(a) Five options were examined, with inconclusive results, largely due to inadequate inventory information. However, although a firm preference cannot yet be identified, some preliminary observations are possible.

(b) The camp option may pose difficult development suitability problems, associated with difficult climatic conditions and a flooding hazard. It appears that most potential impact problems could be satisfactorily mitigated.

(c) Comments on the expansion of Kinaskan are as for the Red Chris project (see point F1#2(c), above), except that there would be additional very serious impact concerns in connection with road access. Based on commuting distance constraints, only a road through the Raspberry Pass in Mount Edziza Park would make this settlement option feasible for the Schaft Creek project. As noted below (see point FII#3(c)), selection of this road access corridor would have the following implications:

- park management strategies would have to be entirely reoriented, and it would be more difficult to preserve scenic and wilderness values;

- major wildlife impacts would be anticipated, and these may be largely non-mitigatable; and

- heritage resources along the pre-historic/historic Telegraph Trail may be impacted.

(d) Expansion of Telegraph Creek is technically feasible, since the local steep canyons can be avoided. Climate is very favourable. It would be necessary to avoid agricultural lands. Among the more important impact concerns are increased pressures on fish and wildlife resources, impacts on heritage resources, and proximity to Mount Edziza Park.

(e) Expansion of Bob Quinn Lake appears to be the preferred option from an environmental standpoint. Site conditions are favourable, since steep hazard lands to the east can be avoided. The site is attractive in terms of views, water supply and hunting and water-based recreation opportunities. Environmental impacts at this site can probably be mitigated, although problems may be associated with an access road in the More Creek corridor (see point 3(d), below).

(f) Although suitable land is available, the Mess Lake townsite option is not generally favoured. The climate is relatively severe, although the mountain views and hunting opportunities would be appealing. It should be possible to avoid local geothermal springs, mineral deposits, avalanche zones and floodplains. However, major environmental impact concerns are noted, including: proximity to the wilderness values of Mount Edziza Park; visual, wildlife and heritage resource impacts within both the Mess valley and Mount Edziza Park; and the impacts of the necessary road access in the Mess valley (and possibly also through the Raspberry Pass).

3. Road Access

(a) Three road access corridors - the Mess, Mess-Raspberry and More corridors - were examined. Although data deficiencies have inhibited analysis, some preliminary observations are noted.

(b) The Mess corridor may involve difficult winter maintenance problems, due to high snowfalls and unfavourable aspect. Several important impact concerns may be noted, including impacts on: the wilderness recreational values of the neighbouring Mount Edziza Park; on agricultural lands at Telegraph Creek and in the Stikine valley; on moose habitat and guide/outfitter activities, especially in northern portions of the corridor; on Indian fisheries along the Stikine River; and on heritage resources at the junction of the Stikine and Mess valleys.

(c) Provisionally, the Mess-Raspberry corridor is considered an undesirable option, because of its probably dramatic direct and indirect impacts on Mount Edziza Park. Impacts on the park's wilderness values, wildlife and heritage resources (along the Telegraph Trail) are major concerns, as is the likely need for substantially increased park management effort. Data on fisheries are insufficient for judgements. Severe winter maintenance problems are expected, especially in the Raspberry Pass.

(d) The More corridor is provisionally preferred, primarily because it makes possible an expanded settlement option for Bob Quinn Lake. However, severe winter conditions and a variety of impact concerns (fisheries impacts downstream along the lower Iskut River, proximity to Mount Edziza Park, impacts on summer wildlife habitat, etc.) should not be overlooked. Moreover, the BC hydro proposal to dam More Creek could render this route option technically impractical. Nevertheless, from an environmental standpoint, it is preferred that every technical effort be made to retain this option. It avoids agricultural lands, areas of high heritage resource potential, and the better wildlife ranges. Crossings of the Stikine River would not be required, and management of access to Mount Edziza Park would be most readily achievable.

4. Transmission Line Corridors

(a) Three corridors were examined - A1(B1)(More), C1 (Highway #37-More), and C2 (Stikine-Mess). Based on available information, which exhibits many deficiencies, it is not possible to state a concrete corridor preference, although some indications can be offered.

(b) Corridor A1(B1) is likely to be preferred, since it parallels the preferred road access corridor. High winds and winter icing would pose technical problems. The downstream fisheries values of the Iskut River could be affected. The potential for heritage sites is low. Soils/terrain, recreation and wildlife information is lacking.

(c) Comments on corridor A1(B1) are applicable to corridor C1. In addition, scenic values along Highway #37 could be affected.

(d) Corridor C2 is not preferred, based on the assumption that the main minesite road access would not be from the north. Impacts on agricultural, recreation/aesthetic and heritage resources are among the most important concerns. Soils/terrain and fisheries information is lacking. However, in general, it is preferred that development avoid the Stikine valley, where possible.

5. Resource Management Implications

(a) Even if other mines do not proceed, this very major mining development will result in substantial increases in the responsibilities and tasks of resource management agencies (inventory, regulation and enforcement, etc.).

(b) Much more detailed baseline information is required for the fisheries along the tributaries to the Stikine River, and for heritage resources, soils/terrain, climate, agricultural capability, and wildlife.

(c) The Parks and Outdoor Recreation Division has indicated that the mine will likely necessitate a substantial increase in park management effort, with the increase depending on which access corridor is selected. In order of progressive increase in the required levels of park management, the road access corridors are ranked as follows:

- least - More corridor;

- intermediate - Mess corridor;

- greatest - Mess-Raspberry corridor.

FIII. - STIKINE COPPER PROJECT

1. Minesite

(a) Major impacts on resource values in the Stikine valley are possible, depending on the exact minesite location and design.

(b) Development suitability is likely to be constrained by steep terrain, high snowfalls, avalanching and high winds.

(c) Impact assessment, even at a preliminary level, is hampered by a lack of information on fisheries, wildlife, recreation resources and land status.

2. Settlement Options

(a) Only a camp option is currently being considered for this project.

(b) Development suitability problems are likely to be associated with a harsh climate, the local avalanche potential and a possible shortage of water. The plateaulands at the junction of the Scud and Gralene valleys should be avoided. Site aesthetics and recreation opportunities are positive features.

(c) Impacts on wildlife resources in the Scud River valley are expected. Other impact projections cannot be made with the existing baseline knowledge.

(d) One possible campsite location which could be examined in the future has been identified near the mouth of the Scud River, just north of the Porcupine River. The site has relatively favourable climatic and topographic conditions, and might also serve other resource activities as a camp (or town) location.

3. Road Access

(a) Only one option - the Mount Hickman tunnel option - was examined.

(b) Construction access to the tunnel portals would be difficult. Within the Stikine valley, unstable soil conditions may also pose problems.

(c) The route would benefit mineral development, timber harvesting and fire protection activities.

(d) Impacts on many resources, notably fish, wildlife and recreation/aesthetics, cannot be predicted without further baseline data.

(e) Another road access option which may have merit is to follow the Iskut River to the Stikine valley, and then northwards to the mine (via the Scud or Anuk valleys). The road corridor could depart from Highway #37 via either the Teigen Creek or Iskut valleys. Such a route might be developed in the context of any or all of the following:

- the Stikine Copper Project;
- BC Hydro's proposed Iskut-Stikine development;
- mineral exploration activities at Mount Johnny; and
- the joint BC-Alaska transportation studies for the Stikine valley.

This corridor alternative is merely being suggested at this time. No attempt has been made thus far to assess its environmental implications.

4. Transmission Line Corridors

(a) Three corridor options have been examined - corridor A1(B1) (More-Porcupine/Sphaler), corridor C1 (Highway #37-More-Porcupine/Sphaler), and corridor C2 (Stikine). Although detailed information is lacking for many resources, it appears that corridor A1(B1) would be preferred. This conclusion, however, should be verified by means of more detailed work.

(b) Corridor A1(B1) experiences severe winter conditions (including heavy snowfall, icing and high winds). Its development could adversely affect timber values in western portions of the corridor. Data for fisheries, wildlife and recreation are insufficient for even a preliminary evaluation. Heritage resource potential is believed to be low.

(c) Comments for corridor C1 are similar to those for corridor A1(B1). Scenic values along Highway #37 would hopefully be protected by appropriate impact mitigation (e.g. screening).

(d) Corridor C2 is not a preferred option because of its potentially major impacts on a variety of resource values in the Stikine valley (fisheries values below the Stikine Canyon, agricultural values, timber values and heritage resource values (between the Site Z substation and Telegraph Creek). Terrain/soils conditions are probably reasonably favourable.

(e) Both corridors A1(B1) and C1 appear to be feasible and acceptable, although some agencies feel that, if the Mount Hickman tunnel is constructed for road access, the transmission line should follow More Creek upvalley to the tunnel, thereby avoiding the Procupine and Sphaler systems.

5. Resource Management Implications

(a) Baseline inventory is required for virtually all sectors of the resource base (soils/terrain, climate, land status, fisheries, wildlife, recreation, agriculture, etc.).

(b) Development of this mine could be the initial step in the opening up of the lower Stikine valley to resource activity. Increases in the management responsibilities of resource agencies would inevitably follow.

G. MINE GROUP V - ADANAC MOLYBDENUM PROJECT

1. General

(a) Planning for this mine has reached a very advanced stage, and a recommendation on the question of Stage II approval-in-principle is now before the Environment and Land Use Committee, although a decision has been deferred for the present, pending a more imminent company decision to proceed.

(b) For this reason, preliminary evaluations of the minesite, its settlement options and road access are redundant.

(c) However, since the feasibility of linking the Atlin area to a regional power grid is being considered as part of this study, some transmission line corridors were examined. It should be stressed that the company's current project planning is based on a hydro-electric dam on Atlin Lake/Surprise Lake.

2. Transmission Line Corridors

(a) Three corridor options were examined - corridor A1 (Stikine-Nahlin/Taku), corridor A2(C1) (Highway #37-Jennings), and corridor B1(Pine).

(b) A variety of impacts are foreseen if corridor A1 is developed. Although fisheries information is generally scarce, it is expected that there would be impacts on the salmon fisheries of the Tahltan River. Impacts on the scenic values of the Telegraph Creek road, on the heritage/recreational values of the Telegraph Trail, on the activities of big-game guides and outfitters, on agriculture around Telegraph Creek and on landowners in the Stikine and Taku areas are among the principle concerns.

(c) Corridor A2(C1) would be expected to affect scenic values along Highway #37, heritage values in the Dease valley, agricultural lands, and extensive areas of wilderness. Very little fisheries information is available.

(d) Corridor B1, the company's preferred option, has been found to be acceptable to provincial Ministries at the working level, despite expected impacts on timber lands.

(e) Corridor B1 is strongly preferred in view of its short length and restricted overall impacts on all resources. If either corridor A1 or A2(C1) were to be seriously considered, corridor A2(C1) would be preferred to avoid potential impacts in the Nahlin-Taku area. However, if the Atlin area is to be linked to a power grid, perhaps a shorter link to future power developments on the Yukon River would be more practical.

3. Resource Management Implications

(a) Baseline data inventory is required for both corridors A1 and A2(C1) for almost all sectors of the resource base (including land status, soils/terrain, climate, fisheries, wildlife, recreation/aesthetics, and heritage resources).

IV. SUMMARY OF FINDINGS BY RESOURCE SECTOR

1. Land Status

(a) Lands status information is not readily available for most of the study area, although the Lands and Housing Regional Operations Division has ready access to some current information on leaseholders, etc. in a few key locations. In particular, land status data are contained in planning reports on the Meziadin, Telegraph Creek and Stewart Harbour areas, and along the Highway #37 corridor.

(b) Readily available uptodate land status information for the study area is considered essential for the type of multiple development which is envisaged. However, the provincial file data are not computerized, and consequently, the compilation of land status information for a large study area would be very time-consuming for the Surveys and Land Records Branch. Moreover, once compiled, regular updating would also be very time-consuming.

(c) It is recommended that, for more restricted "core" areas, where developments are most probable, consideration be given to the preparation of a series of land status maps, perhaps using a generalized land classification system to reduce the time required. While detailed land status data are required for site-specific project assessments, it may be sufficient for regional-scale assessments to be based on a division of lands into the following highly generalized categories:

- Private land

- Crown land
  - vacant
  - allocated or under application
  - reserved.

It is usually possible to plot such simplisitic tenure distinctions on relatively small-scale maps (1:250,000 or smaller), at least in a generalized manner.

(d) Increased staff resources will likely be required to process the anticipated considerably greater numbers of Land Act tenure applications, should major mine-based development proceed. Enforcement of trespass regulations will also become a greater task as the regional population expands. Illegal squatting of construction workers is one typical problem associated with the construction of major developments.

2. Soils/Terrain

(a) Virtually no regional-scale (1:50,000) mapping is available for the study area. About 30% of the area has been mapped at a

strategic planning scale (1:250,000). Based on the locations of development proposals, the key areas of coverage deficiencies at this scale are the upper Skeena basin and the Atlin area (mapsheets 94/D, 104/A, 104/N, 104/O, 104/P and southern half of 104/H).

(b) Soils/terrain mapping forms the primary basis of the Ministry of Environment's biophysical mapping program. Intially, the 1:250,000-scale mapping could be completed for the most relevant "core" areas within three years, if a four-person crew could be made available.

(c) In the longer term, 1:50,000-scale coverage will eventually be required as a basis for more detailed development planning, as it was in the Northeast Coal Block.

(d) Hazardous terrain conditions are frequently encountered in this remote and rugged region. Development will have to contend with the common occurrence of avalanching, slope failures, flooding and materials which are difficult to engineer safely (e.gs. siltstones, lacustrine and organic soils). Gravel resources are known to be scarce in most areas.

3. Vegetation

(a) No regional-scale (1:50,000) or strategic-planning-scale (1:250,000) vegetation mapping is available for the study area.

(b) Vegetation data are an important component of the Ministry of Environment's biophysical mapping program, with numerous applications in the field of land capability interpretation. A 1:250,000-scale survey, covering a corresponding area to that covered by the existing and proposed 1:250,000-scale terrain/soils mapping, would benefit both resource managers and developers.

(c) In the longer term, 1:50,000-scale coverage will eventually be required as a basis for more detailed development planning, as it was in the Northeast Coal Block.

(d) The Ministry of Environment currently does not have the necessary staff resources for 1:250,000-scale and 1:50,000-scale vegetation mapping.

4. Climatology/Meteorology

(a) Climatic data were collected for several years during the period up to 1979 in some portions of the study area. Moderately good coverage is available for the Stikine basin (except between the Tanzilla River and Glenora), and also for portions of the Iskut basin. The Mount Edziza Park/Mess valley area and most areas east of Highway #37 have poor to non-existent data coverage.

(b) A reasonably long-term (5-to-10-year) regional climatic station network is normally considered a basic pre-requisite to short-term site-specific climatic observations for individual development proposals. If major mine-related developments are to proceed, establishment of a regional station network should be considered for areas of climatic data deficiency. The Waste Management Branch does not have the necessary staff resources for such a program.

(c) Severe winter weather will constrain development throughout the region. Deep snowfalls, very wet snow, avalanche hazards and severe icing problems are experienced in many mid- and high-elevation locations.

(d) Climatological factors will feature prominently in the siting of camps and townsites. Sheltered, low-elevation sites with good aspect, located upwind of dust sources, are obviously recommended. Excessive exposure and low temperatures make sites above the tree line impractical. Climatic monitoring should commence at settlement site alternatives as soon as these have been more firmly established. Solar radiation measurements would be beneficial, in addition to the usual temperature, precipitation and wind monitoring.

5. Avalanche Hazard

(a) There is virtually no inventory information available for avalanche hazard distribution in the study area. The Snow Avalanche Section of the Ministry of Transportation and Highways is unable to devote the necessary staff time to generate this type of information over very large areas. It is more geared to site-specific investigations of particular development sites.

(b) Snow avalanche problems are widespread throughout mountainous portions of the study area. A regional survey of avalanche hazard could form part of the terrain/soils mapping program, implemented initially at a scale of 1:250,000 by the Ministry of Environment. However, it is stressed that a regional inventory is no substitute for site-specific investigations when detailed development proposals are being formulated.

(c) It should be noted that avalanche activity occurs near almost all of the camp and townsite options. Avoidance of hazardous areas will feature prominently in settlement site location studies. In many valleys, there is little room between valley-side avalanche zones and valley-bottom flood zones for either camps or townsites.

6. Air Quality

(a) Virtually no baseline air quality information exists for the Study Area (except around the Cassiar Asbestos Mine). This

deficiency will hamper strategic planning for air quality in this region (see also point #9, below - Waste Management).

(b) A limited regional baseline monitoring program would be desirable as a basis for project-specific assessments, although except when fires are burning, current regional air quality should be excellent. One technician may be able to handle the workload.

(c) Railway development will be associated with dusting problems, primarily during the construction phase. However, special coal dust suppression measures will be required for rail operations if coal is transported by rail.

(d) Dusting will be associated with both the construction and operations/maintenance phases of road development. Appropriate dust suppression measures will be required.

(e) During transmission line construction, dusting will cause problems. During operations, buffer zones must be established on both sides of overhead high-voltage lines to minimize the adverse biological impacts of their electrical and magnetic fields. Moreover, ozone may be generated, and this could affect vegetation development.

(f) The individual mines will pose a variety of air quality problems which can be individually addressed through the relevant review guidelines. Typical problems will include fugitive dust and trace metal contamination (e.gs. coal dust, asbestos). The locations of camps and townsites should be sensitive to this consideration. Windspeed and wind direction data will be required for all new mines and all new settlement site options.

(g) Given the pristine regional air quality, town development will inevitably lead to some air quality deterioration, although without much more detailed settlement proposals, it is impossible to estimate levels of impact with any degree of confidence. All settlements should be located upwind of minesites and other sources of air contaminants as a basic siting requirement.

(h) The Klappan Thermal Power Project is of particular concern in view of its potential local and regional air quality effects. Detailed knowledge of SO_x, NO_x and other emissions, local windspeeds and wind directions, inversion climatology and local atmospheric ventilation capacity will be required as part of air quality evaluations. Settlement options which are located closer to the minesite than the Tsetia townsite are not considered desirable, given the potential for air emissions which are harmful to human health.

(i) The Turnagain townsite should be located beyond the range of possible asbestos contamination to avoid human health problems such as the respiratory disease, asbestosis. The necessary regulatory guidance would be provided by the Waste Management Branch.

7. Water Management (Water Quantity)

(a) While uncertainty surrounds the availability of baseline hydrological information, it is probable that, except in the Stikine watershed, where BC Hydro has been studying the Iskut-Stikine hydro-electric power proposal, virtually no hydrological information presently exists.

(b) Consideration should be given to the establishment of hydrometeorological stations on key streams for the collection of baseline data over a period of at least 10 years. These data (for low flows, peak flows, etc.) could form a useful framework for regional-scale strategic planning of water resources, and also for project-specific assessments (related to water supply, flood hazard, etc.).

(c) Hydro-electric power development can be expected to have widespread impacts on water quantity, some of which may be non-mitigatable. Whether these impacts are considered "adverse" depends upon the specific details of each dam proposal. None of the five proposed dams would affect licenced water users, although the Cottonwood and Turnagain sites may affect placer mining activities. In the long term, the dams might provide flood control benefits, although few (if any) interests would benefit in the near future.

(d) The various types of linear development which are being considered (railways, roads, pipeline, transmission lines) are unlikely to materially affect water quantity. Water users along the proposed corridors (e.g. placer miners) should not be materially affected, providing that their needs are recognized at the design stage. For all linear developments, primary Water Management Branch concerns will include flood hazards and floodplain definition, erosion potential, and stream crossing design.

(e) The mine guidelines review processes are adequate vehicles for addressing water management concerns in connection with new mines. Conflicts with existing water licences are not expected to be a major problem.

(f) None of the townsites are believed likely to pose major water supply/water use problems. Only at Dease Lake is there the potential for impacts on other licenced water users.

(g) Individual projects can be managed with existing Branch resources. However, the Branch does not presently have adequate staff resources to cope with anticipated increases in the permitting workload.

8. Flooding Hazard

(a) No specific mapped information is available for the study area. However, it is known generally that floodplains and flooding problems are attributes of many of the valley corridors within which development is proposed.

(b) For new towns, mines, highways and other major developments, proponents will be expected to define floodplains for a variety of recurrence intervals (e.g. the 200-year floodplain), but this task will be difficult without a regional hydrological data base.

(c) Since flooding activity can be inferred in a preliminary manner from terrain/soils information, a regional floodplain mapping program could form part of any regional-scale biophysical mapping program which may be implemented by the Ministry of Environment.

(d) However, a regional inventory is no substitute for site-specific investigations when development proposals reach the detailed design stage. As suggested in the comments on water management (see section #7, above), a ten-year hydrometeorological station network would ultimately provide the best form of regional data framework. Within such a framework, shorter-term site-specific stream monitoring could be undertaken with a fair degree of reliability.

9. Waste Management (Air and Water Quality)

(a) While waste management has been basically reactive in the past, the Waste Management Branch feels that, given the considerable development lead time, the opportunity is available for effective advanced planning of all aspects of development, including waste management standards, objectives, etc. for air and water quality.

(b) Water quality and air quality information is not available at this time in sufficient quantity to permit even strategic-level waste management planning. Data have been collected only for a few recent mine developments, and for some lakes along Highway #37.

(c) Consideration should be given to the implementation of regional-scale inventories in order to provide the necessary basis for site-specific assessments. In general, regional water and air quality are expected to be good.

(d) Railway development should pose few waste management problems. Contingency plans for the transportation of dangerous/toxic materials will be required. Wood preservatives which are applied to wooden structures over streams may be toxic to fish, and are of concern to the Branch.

(e) In most respects, regional power developments pose minimal waste management concerns. Construction camps and the transport and storage of transformers which contain PCBs are major interests of the Branch. Eventually, power development proponents (BC Hydro, etc.) will be expected to provide details of locations of camps, fuel storage, and other types of storage.

(f) The mine guidelines review processes are adequate vehicles for addressing waste management concerns in connection with mines.

(g) For all new mining proposals (metal and coal), acid generation investigations will be required. Calcium data collected during 1977-81 lake surveys in the Coast Mountains reveal only a limited buffering capacity, and hence, a moderate to high sensitivity to both acid generation and acid precipitation. Further inland, buffering capacities are higher, and acidification risks are less.

(h) Aquatic nitrogen concentrations have been found to increase around minesites as a result of blasting. Mine proponents will be expected to address nutrient loading problems in environmental submissions which are filed with the Province. For some lakes with a poor nutrient status, nutrient loading may be beneficial

(i) For new gold mines, it may be that the alkaline chlorination process will not be accepted as sufficient for the destruction of cyanides.

(j) Assuming that water quantity is not limited, water quality issues are unlikely to feature prominently in the current, highly preliminary settlement option selection process. A variety of treatment options are available for the numerous types of waste discharges which can be expected. For some lakes, nutrient enrichment may be beneficial.

(k) Development of the proposed scope and scale will require additional staff resources if effective waste management programs and timely processing of permits are to be achieved. It is possible that, for the more major developments, specific water and air quality objectives will be set on a case-by-case basis.

10. Coal and Mineral Resources

(a) Considerable knowledge of mineral resources has been acquired within the study area. However, data collection has involved numerous public and private groups, and consequently, data collection methodologies and data reliability are highly variable. Data coverage, then, is uneven from one location to

another, although generally good around the proposed mining developments.

(b) The region is known to be generally well-endowed with mineral resources, and also contains coal resources in the Groundhog/Mount Klappan area. The Ministry of Energy, Mines and Petroleum Resources is keen to encourage development of these resources during the foreseeable future, and will tend to favour land use and surface resource allocation options which do not constrain access to, and development of, these subsurface resources.

(c) The environmental and socio-economic acceptability of all new mining projects can be assessed through application of the mine guidelines review processes in accordance with provincial policies.

(d) Companies will be expected to avoid subsurface resource sterilization through careful location and design of mine facilities. Other developments (towns, camps, linear developments, etc.) should also be sited so as to minimize conflicts with subsurface resources, placer leases, mining claims, coal licences, aggregate sources, etc.

(e) Mineral developments of the envisaged scope and scale would likely require increased Ministry inspection capability.

(f) Additional geological staff support will likely also be required for various purposes:

- verification of the geological data which form the basis for mining proposals, especially in cases where public investment in infrastructure is requested; and

- evaluation of the siting of developments (including mines, towns, camps, linear developments, etc.) in relation to subsurface resources, in order to ensure that there is no loss (sterilization) of subsurface resource potentials.

1. Gravel Resources

(a) No information on gravel resources is available for the study area, except for that which can be derived from the small-scale terrain/soils mapping which is available for some areas (see point #2(a), above).

(b) A regional-scale terrain/soils inventory could provide a preliminary overview of the likely distribution of potential aggregate sources. However, there is no substitute for site-specific investigations when determining the availability and usability of a potential source in a particular situation.

(c) The Geotechnical and Materials Branch (Ministry of Transportation and Highways) does not have the necessary resources to undertake a regional review of possible aggregate sources. However, given the necessary staff resources, the Ministry of Environment could conduct a biophysical mapping program which would provide at least a strategic-planning-scale assessment of the distribution of potential gravel resources.

(d) Gravel shortages are reported in this region. Given the substantial but unpredictable nature of the anticipated gravel demand, gravel supply issues could be prominent. Participants in Northwest Economic Development would benefit from strategies designed to rationalize the gravel supply situation.

12. Wildlife Resources

(a) Baseline inventory must be undertaken before it is possible to attempt even the most rudimentary type of project assessment within most portions of the study area.

(b) Inventory of species presence/absence, population levels, habitat preferences, critical habitats, species displacement potential and migration patterns is essential. Initially, strategic-planning-scale wildlife mapping (at 1:250,000) may provide a useful regional overview. However, for reasonably reliable project assessment work, 1:50,000-scale biophysical wildlife capability mapping, such as is normally implemented by the Ministry of Environment, would be a basic minimum requirement. That Ministry would be unable to implement such a mapping program with existing staff resources.

(c) Most types of major development will affect the interests of guide/outfitters, registered trapline holders and Native Indians. Compensation of these individuals is more likely to be successful than mitigation as an approach to impact management.

(d) Development of the proposed scale and extent would necessitate the allocation of significant new staff resources for resource management in the northern sector of the study area. Enforcement of more stringent harvesting regulations will be required, preferably with additional staff being provided prior to the improvement of access.

(e) In addition, it would be necessary for all development planning to proceed with the following in mind:

- avoidance of critical wildlife habitats, where possible; and

- a preparedness to consider innovative approaches to mitigation, such as habitat enhancement projects.

13. Fisheries Resources

(a) Given that important salmon drainages are present, substantial new baseline inventory will be needed in order to make possible even the most basic project assessments in the study area. Some highly preliminary mapped information (at scales up to 1:250,000) is available for portions of the Skeena/Nass drainage, the Sturdee Road corridor, the Turnagain drainage and the Stikine/Iskut/Unuk drainage (west of Highway #37). No inventory data are available for areas north of the Stikine drainage.

(b) Inventory of species presence/absence, population levels, habitat preferences, critical habitats, species displacement potential and fish migration patterns is essential. Priority should be placed on the Stikine basin east of Highway #37, especially on the Klappan/Little Klappan system. Strategic-planning-level aquatic biophysical mapping (at a scale of 1:250,000) would provide a useful initial overview. Eventually, however, regional-scale mapping (1:50,000) would become a basic minimum requirement if several major developments actually proceed to the detailed design stage.

(c) Most types of major development will affect the fishing interests of Native Indians. Compensation of these individuals is more likely to be successful than mitigation as an approach to impact management.

(d) Development of the proposed scale and extent would necessitate the allocation of significant new staff resources for resource management in the northern sector of the study area. More stringent harvesting regulations would be required. The outstanding inventory work could be accomplished by one biophysical survey crew, working for two or three years.

(e) In addition, it would be necessary for all development planning to proceed with the following in mind:

- a preparedness to consider innovative approaches to mitigation, such as habitat enhancement projects, restocking projects, etc.; and

- protection of lakes and streams from chemical discharges through effective environmental design.

14. Agricultural Resources

(a) There is a general lack of agricultural capability information for the study area, although the recently-completed Stikine valley biophysical mapping of the Terrestrial Studies Branch confirms the presence of some of the best agricultural lands to be found north of Smithers, located between Telegraph Creek and Glenora.

(b) It would be useful to collect baseline information on terrain/soils, soil capability and climate capability for agriculture in other selected portions of the study area. However, except in the above-noted stretch of the Stikine valley, agricultural values are believed to be low. The Ministry of Agriculture and Food has assigned a "low" priority to most portions of the study area, and the Ministry of Forests has also assigned a "low" priority to range resources in most areas.

(c) The Ministry of Agriculture and Food does not anticipate any major conflicts between the proposed mining developments and agricultural activities, and in fact foresees a beneficial impact on agricultural production in terms of increased local markets, providing that agricultural lands are avoided by development. The Ministry generally discourages developments which encroach upon the agricultural lands of the Stikine valley between Telegraph Creek and Glenora, and is consequently concerned over some of the various settlement and linear development proposals in this area.

(d) The Ministry of Agriculture and Food and the Minstry of Forests do not anticipate development impacts on cropland and range lands which would necessitate increases in program staffing at this time.

15. Timber Resources

(a) Based on the existing timber inventory, which is considered generally adequate, timber resource development has a low priority in the study area. Timber resources are of marginal quality and are remote from markets.

(b) The primary concerns of the Ministry of Forests would be those related to forest recreation (see Outdoor Recreation Resources/Aesthetics, point #16, below) and fire protection.

(c) Increased fire protection program needs are expected due to:

- increased risk of man-made fires associated with increases in recreation activities, etc.;

- increased fire hazard associated with land clearing activities; and

- a substantial increase in human and property values which must be protected.

(d) Given multiple developments of the proposed scope and scale, the Ministry of Forests would likely require additional technician staff to monitor right-of-way clearing, pondage clearing and increased timber harvesting, and also to handle fire protection responsibilities.

16. Outdoor Recreation Resources/Aesthetics

(a) Both the Parks and Outdoor Recreation Division and the Ministry of Forests presently possess only a limited site-specific knowledge of recreation features and opportunities in most of the study area.

(b) A regional inventory of recreation resources (features, recreation carrying capacity, aesthetics, etc.) would provide a much more reliable basis for preparing individual project assessments, and for comparing project alternatives, initially at a scale of 1:250,000, but eventually at a regional mapping scale (1:50,000).

(c) The potential impacts of the proposed developments on Mount Edziza and Spatsizi Parks are of particular concern. Development of road access adjacent to or through these parks would necessitate major changes in park management strategies. More intensive management would be required to handle greatly increased park usage, and this would likely necessitate increases in staffing. Benefits in terms of increased access are considered attainable, providing that park management concerns are addressed during project planning.

(d) Proximity of Mount Edziza Park to both the Mess Lake townsite and the road options in the Mess valley is of concern. The preferred road access and settlement options for the Schaft Creek project would be those which are located as far from the park as possible. Road access through Raspberry Pass would have a major impact on views, recreation features, wildlife, and historic and archaeological resources.

(e) Proximity of Spatsizi Park to the road access and townsite options for the Klappan project is also of concern. It is preferred that the mineworkers be settled south of the minesite to minimize the proximity of a large population centre to the park, and to avoid major road access development in the Little Klappan valley.

(f) Also of concern are the potential aesthetic impacts of linear developments on the Highway #37 corridor, the Bear corridor, the Dease Lake-Telegraph Creek road, the Stikine River and the Dease River, all of which are considered to be provincially significant tourist attractions. Without firmer route proposals, it is impossible to identify route preferences at this time.

17. Heritage Resources

(a) To date, only a few very superficial heritage inventory studies have been conducted in the study area. More specifically, studies have been confined to:

- the Stikine River valley between the McBride River confluence and Glenora (below Telegraph Creek);

- the Raspberry Pass in Mount Edziza Park;

- Kinaskan Lake;

- Atlin Lake;

- Meziadin Lake;

- the Liard River valley; and

- the Skeena River valley.

There is virtually no existing information for other portions of the study area, although there is reason to expect sites to be present in the high plateaulands of the Stikine/Atlin region, and in the major valleys.

(b) Given this situation, the Heritage Conservation Branch will expect detailed heritage resource impact assessments for all of the major development proposals which are actively pursued. The Branch will not be in a position to supplement private sector work with its own studies, given its present staff resources.

(c) In most cases, heritage sites can be avoided through judicious project siting. Where this not possible, various mitigation options are available, including site salvage.

(d) The Branch is concerned over proposed road development in the Raspberry Pass, which is known to have one of the densest concentrations of heritage resources in the Province, relating to cultural activities over the past 8,000 to 10,000 years. The Raspberry Pass contains one of the few remaining intact sections of the ancient Telegraph Trail.

APPENDIX A

ENVIRONMENTAL AND SOCIAL IMPACT GROUP

TERMS OF REFERENCE

(1982-06-29)

NORTHWEST ECONOMIC STUDY

ENVIRONMENTAL AND SOCIAL IMPACT GROUP (ESIG)

TERMS OF REFERENCE

(82-06-29)

1. Purpose

To prepare a preliminary assessment of the potential regional impacts of two major development scenarios to the year 2001 AD, based on the implementation of a series of mining projects.

2. Definition of Development Scenarios

Before the ESIG can begin its program in earnest, it requires reasonably precise definitions of the two development scenarios which are being considered.

(i) From the Mineral Resources Group, the following general information is required for each mining proposal:

- timing for each scenario;
- location;
- size of production for each scenario;
- size of directly disturbed area;
- ore or coal processing needs; and
- size of construction and operating workforces for each scenario.

(ii) From the Transportation Group, the following general (mapped) information is required for each scenario:

- a proposed network of road corridors (actual routes where possible), with corridor options noted where alternatives exist;
- any proposed extension of the existing rail network; and
- any potential sites for airports capable for receiving large commercial jets.

(iii) From the Energy Group, the following general (mapped) information is required for each scenario:

- location of all proposed energy sources, with options noted where alternatives exist;
- a proposed electrical distribution corridor network, with transmission line corridor options noted where alternatives exist; and
- if appropriate, a proposed petroleum/natural gas distribution corridor network, with pipeline corridor options noted where alternatives exist.

(iv) From the Municipal Group, the following general information is required for each scenario:

- locations of possible townsite options in situations where town development is a possibility;
- potential areas of townsites and sizes of town populations; and/or
- locations of possible sites for camps where town development is either inappropriate or too distant.

Interaction with this group will be close, and its townsite options are likely to be influenced somewhat by whatever urban suitability data the ESIG generates.

(v) It will be necessary for the ESIG to produce a 1:600,000-scale map for each development scenario, based on the combined inputs of the other four working groups.

(vi) It will be necessary for the Interministry Task Force to clarify with the Cabinet Committee on Economic Development:

- what information can be circulated to facilitate the ESIG's tasks;
- which provincial staff are authorized to participate in the ESIG's program;
- which federal departments (if any) are authorized to participate in the ESIG's program; and
- which local governmental and non-governmental groups (if any) are authorized to participate in the ESIG's program.

3. Approach

(i) The ESIG intends to circulate the combined information on each development scenario to each agency which is authorized to participate in the ESIG's program. Each participating agency will also be provided with a series of questions, possibly in questionnaire format.

(ii) Since the Study Area is not generally well known and inventory information is likely to be scarce, participants will be asked to rely heavily on personal knowledge and professional judgement in responding to the ESIG's information requests. It is unlikely that substantial quantitative information is readily available for most resources at present, and it is expected that ESIG's report to the Interministry Task Force will be largely a qualitative judgemental assessment, particularly with respect to biophysical impacts.

(iii) For the social impact component of the study, review comments which are provided by participating agencies will be supplemented by archival research and a literature review.

4. Participants

(i) Biophysical Participants

It is proposed that those agencies with regulatory and advisory mandates with respect to the following resources be involved in the ESIG's program:

- Crown land (MLPH);
- air quality (MOE);
- water quality (MOE);
- water quantity (MOE);
- fisheries (MOE, DFO?);
- wildlife (MOE);
- hazard lands (various);
- agriculture (MAF, MF);
- timber (MF);
- recreation/aesthetics (PORD, MF); and
- heritage resources (HCB).

The Skeena Resource Management Committee will be asked to participate in the study.

(ii) Socio-Economic Participants

Likewise, agencies with mandates in the following socio-economic areaswill also be involved in the program:

- native Indians (MAG, DIAND?);
- manpower and labour force (ML);
- health (MH);
- education (M.Ed); and
- social services (MHR).

5. Baseline Data

(i) Biophysical Data

For each resource listed in #4(i) above, questions will be designed to establish the following:

- current status of resource base;
- status of inventory/inventory deficiencies;
- provincial priority/regional priority;
- present level and value of resources use; and
- current projections for future use without major mine-related developments.

(ii) Socio-Economic Data

Additional questions to socio-economic agencies will be designed to establish the following:

- current level of existing programs, services, and facilities;
- present capacity and utilization of services and facilities; and

- projections of future demand for services and facilities without major mine-related developments.

6. Impact Assessment

(i) Biophysical Impacts

For each development scenario, questions will be asked on the following topics in order to establish, at least qualitatively, the potential scope and importance of the impacts of each development scenario on each resource listed above in point #4(i):

- for each mine, transport route, energy supply option and townsite option, the nature and magnitude of direct impacts;
- for each mine, transport corridor option, energy supply option and townsite option, the nature and magnitude of indirect impacts on resource users and government resource management programs; and
- where a choice of options exists for corridor development, energy supply and townsite development, the preferred option(s), with rationale.

For each development scenario, cumulative regional impacts should be rated, the two scenarios compared, and a preference identified.

(ii) Socio-Economic Impacts

Socio-economic agencies will be asked to provide a preliminary comparative evaluation of the potential range and extent of social impacts for each development scenario as well as each settlement option.

Likewise, the socio-economic impacts of each settlement option will be rated and ranked from most to least desirable in terms of agency concerns.

7. Impact Management

For those impacts which are identified, it may be possible for some agencies to suggest impact management measures, particularly:

- additional baseline inventory;
- potential changes in resource management needs (staffing, funding, etc.);
- potential changes in service and program delivery mechanisms; and
- possible options for public participation in the planning and social impact management processes.

At this preliminary stage, it is likely that project-specific mitigation or compensation proposals would be premature Suggestions on appropriate future planning processes may be forthcoming

8. Timing

(i) The other four working groups should provide the information listed above in point #2 by the last week in July, 1982.

(ii) One week will be required to draft the complete development scenarios on to maps and to develop a final series of questions.

(iii) The maps and questions should be forwarded to study participants in the first week in August, 1982, with a review deadline of mid-September, 1982.

(iv) The results of the review should then be compiled for submission to the Interministry Task Force as a draft at the end of September, 1982.

(v) The results of the ESIG's review of the urban suitability of the townsite options will be conveyed to the Municipal Group by the beginning of September, 1982.

Drafted by:

Raymond L. Crook
Chairman
Environmental and Social Impact Group
Northwest Economic Study

1982-06-29

RLC:vv

APPENDIX B

ESIG PARTICIPANTS

ESIG PARTICIPANTS

The following agencies and staff participated directly in the ESIG's program, and their contributions are acknowledged.

1. Ministry of Energy, Mines and Petroleum Resources

   Mineral Resources Division

   - Inspection and Engineering Branch

     Victor Pakalniskis
     Ralph McGinn
     Terry Vaughan-Thomas

   - Geological Branch

     Gib McArthur

2. Ministry of Environment

   - Regional Director

     Don Smuin

   - Fish and Wildlife Branch

     David Reynolds

   - Waste Management Branch

     Terry Roberts
     Rick Wilson

   - Water Management Branch

     Wilf Dreher
     Ron Buchanan

   - Planning Branch

     John Dick*

     * ESIG Co-chairman and primary MOE contact

   - Surveys and Resource Mapping Branch

     Norm Sprout

3. Ministry of Agriculture and Food

   - Farmland Resources Branch

     Harvey Sasaki

   - District Agriculturalist

     Graeme Johnstone

4. Ministry of Forests

   - Strategic Studies Branch

     Wayne Swanson

   - Regional Manager

     Jack Biickert

5. Ministry of Lands, Parks and Housing

   - Land Planning Branch

     Bill Hubbard

   - Lands and Housing Regional Operations Division

     Jack Hall

   - Parks and Outdoor Recreation Division

     D.E. Green (Regional Director)
     Roger Norrish

6. Ministry of Provincial Secretary and Government Services

   - Heritage Conservation Branch

     Harry Diemer

7. Ministry of Transportation and Highways

   - Design and Surveys Branch

     Mike Kent

   - Transportation Branch

     Peter Lofthouse

- Avalanche Coordinator

  Geoff Freer

- Geotechnical and Materials Branch

  John Kerr

8. Ministry of Municipal Affairs

   - Planning Branch

     Gary Paget
     Connie Halbert

   - Regional Office

     Peter Ostergaard

9. Skeena Resource Management Committee

   - Chairman

     Tom Schroeter

10. Omineca-Peace Resource Management Committee

    - Chairman*

      Hank Boas

* for information only, since it presently appears that very little (if any) of the Study Area falls within the region.

APPENDIX C

THE DEVELOPMENT OPTIONS

C1 - Proposed Mining Developments

C2 - Proposed Settlement Options

C3 - Proposed Roads

C4 - Proposed Railways

C5 - Proposed Pipeline

C6 - Proposed Power Supply Systems

APPENDIX C1

PROPOSED MINING DEVELOPMENTS

BACKGROUND

The following points should be noted:

1. The basic development scenario which was investigated is presented on the attached table.

2. The development scenario is structured around the possible dates for initiating development and production at nine new mines.

3. The table shows all of the information which has been provided to date, namely:

   - start-up date;
   - estimated mine life;
   - estimated mill capacity;
   - estimated concentrate output; and
   - estimated production workforce.

   Details of minesite layout, milling or preparation plant processes, etc. are not yet available (except see points #5, #6 and #7, below). Clearly, only very general responses can be given to questions relating to minesite impacts at this time.

4. From the information which is available to date, it appears that preliminary infrastructure planning is being tailored towards groups of mines rather than individual mines. For this reason, the questionnaire which was circulated to resource agencies was structured around the following mine groupings:

   Group I - Sustut Copper Project

   Group II - Klappan Coal Project

   Group III - Eaglehead Copper/Molybdenum Project
   - Letain Asbestos Project
   - Kutcho Creek Copper/Zinc/Silver Project

   Group IV - Red Chris Copper Project
   - Schaft Creek Copper/Molybdenum Project
   - Stikine Copper Project

   Group V - Adanac Molybdenum Project

5. Since the Adanac Molybdenum Project is about to be considered for Stage II approval-in-principle by the Environment and Land Use Committee of Cabinet, a questionnaire seeking preliminary impact

information would have been partially redundant. However, it is possible that attempts will be made to tie Atlin to the rest of the Study Area through linear development linkages. Since these are not part of the current mining proposal, questions related to such corridor development were included in the questionnaire.

6. For the Klappan Coal Project, a coal slurry pipeline may be required to bring coal to Stewart for export (see Appendix C5).

7. For the Stikine Copper Project, it is possible that concentrate may be barged down the Stikine River to open sea.

NORTHWEST ECONOMIC DEVELOPMENT SCENARIO - POTENTIAL MINE DEVELOPMENTS

Mine Group	Mine	Year of Start Up Under this Scenario	Estimated Mine Life	Estimated Mill Capacity (tonnes/day)	Estimated Concentrate Output (tonnes/year)	Estimated Production Workforce
I	Sustut (Cu)	1996	8 years	6 000	55 000	350
II	Klappan Coal	1990	20 years	50 000	5 000 000	1 250
III	Eaglehead (Cu, Mo, Ag, Au)	1995	15 years	10 000	39 000	250
	Letain (Asb)	1990	15 years	2 000	24 000	350
	Kutcho Creek (Cu, Zn, Ag)	1987	11 years	4 300	138 000	450
IV	Red Chris (Cu, Au)	1990	20 years	4 500	24 000	375
	Schaft Creek (Cu, Mo, Ag, Au)	1992	25 years	100 000	318 000	1 200
	Stikine (Cu, Ag, Au)	2000	20 years	30 000	303 000	450
V	Adanac (Mo, Sz)	1989	31 years	14 000	5 000	320

APPENDIX C2

PROPOSED SETTLEMENT OPTIONS

BACKGROUND

A series of documents are attached which, taken together, outline both the rationale for studying possible townsites and the site selection criteria which the Municipal Group requested the ESIG to evaluate. The following points should be noted:

1. Attachment C2-1 indicates the labour force estimates for the development scenario which was investigated.

2. Based on these labour force estimates, and the associated (extrapolated) regional population growth, the Municipal Group concluded that three of the five groups of mines (see Appendix C1 for groupings) may warrant development of new towns (Groups II, III, and IV).

3. Attachment C2-2, Settlement Options (August, 1982) provided very preliminary information of each of the townsites which are under consideration. Some of these sites were entirely new (Kluayetz, Tsetia, Turnagain, Mess Lake), while others involved dramatic expansions of existing, but very small, communities (Dease Lake, Kinaskan, Iskut/Eddontenajon, Telegraph Creek, Bob Quinn Lake, Atlin). These settlement proposals are extremely tentative, and were identified for the purpose of initiating discussion.

4. The approximate locations of the new town options are shown in the attached map (see back pocket). Each large broken circle denotes an area within which a townsite might be located. However, a much smaller area would be required for town development than is actually encompassed by the broken circle symbols.

5. Attachment C2-3, Criteria for Environmental Assessment of Townsite Alternatives (August, 1982), is a guide to the type of biophysical evaluation which the Municipal Group was seeking from the ESIG. This guide assisted with the preparation of questions related to:

   - environmental impacts of the proposed townsites (environmental constraints);
   - urban suitability of the proposed townsites (technical constraints);
   - resource-related opportunities for the town populace (resource opportunities); and
   - concerns related to town access.

6. Attachment C2-4, Critical Site Selection Criteria (August, 1982), provided more specific direction on the urban suitability aspects of the townsite investigation. The final table in attachment C2-4 lists the area of land required for each of the major townsite development options. These critical site selection criteria had already been applied in a preliminary manner by the Municipal Group in order to identify the options for townsites which were later studied by the ESIG.

NORTHWEST ECONOMIC DEVELOPMENT SCENARIO -

POTENTIAL MANPOWER DEMAND

Mine Group	Mine	Workforce	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I	Sustut	construction										280	420	350						
		operating												70	350	350	350	350	350	350
II	Klappan	construction				1000	1500	1250												
		operating						250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250
III	Eaglehead	construction									200	300	250							
		operating											50	250	250	250	250	250	250	250
	Letain	construction				280	420	350												
		operating						70	350	350	350	350	350	350	350	350	350	350	350	350
	Kutcho Creek	construction	360	540	450															
		operating			90	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
IV	Red Chris	construction				300	450	375												
		operating						75	375	375	375	375	375	375	375	375	375	375	375	375
	Schaft Creek	construction						960	1440	1200										
		operating								240	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	Stikine	construction														360	540	450		
		operating																90	450	450
V	Adanac	construction			340	560	390													
		operating					64	320	320	320	320	320	320	320	320	320	320	320	320	320

ATTACHMENT C2-2

SETTLEMENT OPTIONS

Summary

In summary, the options were as follows:

Mining Group	Alternative Settlement Options *
Group I	
- Sustut	- camp (Priority Option)
Group II	
- Klappan	- camp - Kluayetz Town (Priority Option) - Tsetia Town
Group III	
- Eaglehead	- camp for each mine
- Letain	- expand Dease Lake
- Kutcho Creek	- Turnagain Town (Priority Option)
Group IV	
- Red Chris	- for Red Chris - camp - expand Kinaskan (Priority Option) - expand Iskut/Eddontenajon
- Schaft Creek	- for Schaft Creek - camp - expand Telegraph Creek - expand Bob Quinn Lake - expand Kinaskan (Priority Option) - Mess Lake Town
- Stikine	- for Stikine - camp (Priority Option)
Group V	
- Adanac	- expand Atlin (concept close to receiving Stage II approval-in-principle).

* Priority options are those of the Municipal Group

Details

1. Kluayetz Town

For the Klappan Coal Project, this proposal is considered more probable than the Tsetia Town. It is located adjacent to the minesite near the intersection of the Little Klappan River, the Skeena River, the Spatsizi River and Kluayetz Creek. The current estimates of total population are as follows for the Development Scenario, given a 1987 construction start-up date for both the mine and the town:

Year	Projected Total Population
1989	800
1990	2,100
1991-2000	3,000

2. Tsetia Town

An alternative for the Klappan Coal Project, this townsite is located near the junction of the Klappan River, the Little Klappan River, Eaglenest Creek and Tsetia Creek. Population estimates are as for the Kluayetz Town.

3. Turnagain Town

If built, this town would serve the Eaglehead, Letain and Kutcho Creek projects. It would be located in the Turnagain valley somewhere between Kutcho Creek and Cariboo Creek.

The current estimated total town population is as follows for the Development Scenario, given a 1984 construction start-up date for both the town and the Kutcho Creek mine:

Year	Projected Total Population
1986	650
1987	1,100
1988	1,400
1989	1,650
1990-91	1,876
1992	2,200
1993	2,350
1994	2,400
1995-97	2,600
1998	1,500

This town was the Municipal Group's priority option for the Eaglehead, Letain and Kutcho Creek projects for the purposes of this study, although the results of the study appear to favour use of mining camps at each minesite.

4. Dease Lake Expansion

This could serve the Eaglehead, Letain and Kutcho Creek projects. No detailed population projections were available for the Development Scenario, but the existing population is 237 (1981 Census).

5. Kinaskan Expansion

A major settlement south of Kinaskan Lake in the vicinity of the existing Kinaskan settlement (which is currently a primary tourist centre) could serve both the Red Chris and Schaft Creek Projects.

The current estimates of total town population are as follows for the Development Scenario, given a 1987 construction start-up date for both the town and the Red Chris mine:

Year	Projected Total Population
1989	300
1990	900
1991	1,900
1992-2000	3,650

This town is the Municipal Group's priority option for both the Red Chris and Schaft Creek projects.

6. Iskut/Eddontenajon Expansion

Expansion of this twin settlement could be considered for the Red Chris Copper Project. However, this site would be too distant for Schaft Creek workers. Expansion of this settlement would likely be moderate, at most, since this option would likely be coupled with a camp at the minesite. No detailed population projections were available for the Development Scenario, but the existing population is approximately 250 persons.

7. Telegraph Creek Expansion

This would serve only the Schaft Creek Copper/Molybdenum Project. No total population projections were available for the Development Scenario, although the total population is likely to be approximately 2,800, given the existing population of 270 (1981 Census).

8. Bob Quinn Lake Expansion

Comments as for Telegraph Creek (#7, above). No 1981 Census data are available. A town population growth of 2,800 may be projected.

9. Mess Lake Town

A townsite might be located at the western end of the Raspberry Pass just outside Edziza Park, serving the Schaft Creek project only. Its population would be approximately 2,800.

10. Atlin Expansion

If the ELUC grants Stage II approval-in-principle to the Adanac Molybdenum Project in the near future, most of the workforce will be housed in Atlin. Present population is about 250.

NORTHWEST ECONOMIC DEVELOPMENT SCENARIO -
POTENTIAL MANPOWER DEMAND

Mine Group	Mine	Workforce	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I	Sustut	construction										280	420	350						
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		operating											50	250	250	250	250	250	250	250
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	Stikine	construction														360	540	450		
		operating																90	450	450
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ATTACHMENT C2-2

SETTLEMENT OPTIONS

Summary

In summary, the options were as follows:

Mining Group	Alternative Settlement Options *
Group I - Sustut	- camp (Priority Option)
Group II - Klappan	- camp - Kluayetz Town (Priority Option) - Tsetia Town
Group III - Eaglehead - Letain - Kutcho Creek	- camp for each mine - expand Dease Lake - Turnagain Town (Priority Option)
Group IV - Red Chris - Schaft Creek - Stikine	- for Red Chris - camp - expand Kinaskan (Priority Option) - expand Iskut/Eddontenajon - for Schaft Creek - camp - expand Telegraph Creek - expand Bob Quinn Lake - expand Kinaskan (Priority Option) - Mess Lake Town - for Stikine - camp (Priority Option)
Group V - Adanac	- expand Atlin (concept close to receiving Stage II approval-in-principle).

* Priority options are those of the Municipal Group

Details

1. Kluayetz Town

For the Klappan Coal Project, this proposal is considered more probable than the Tsetia Town. It is located adjacent to the minesite near the intersection of the Little Klappan River, the Skeena River, the Spatsizi River and Kluayetz Creek. The current estimates of total population are as follows for the Development Scenario, given a 1987 construction start-up date for both the mine and the town:

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This town was the Municipal Group's priority option for the Eaglehead, Letain and Kutcho Creek projects for the purposes of this study, although the results of the study appear to favour use of mining camps at each minesite.

4. Dease Lake Expansion

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A major settlement south of Kinaskan Lake in the vicinity of the existing Kinaskan settlement (which is currently a primary tourist centre) could serve both the Red Chris and Schaft Creek Projects.

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This town is the Municipal Group's priority option for both the Red Chris and Schaft Creek projects.

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Expansion of this twin settlement could be considered for the Red Chris Copper Project. However, this site would be too distant for Schaft Creek workers. Expansion of this settlement would likely be moderate, at most, since this option would likely be coupled with a camp at the minesite. No detailed population projections were available for the Development Scenario, but the existing population is approximately 250 persons.

7. Telegraph Creek Expansion

This would serve only the Schaft Creek Copper/Molybdenum Project. No total population projections were available for the Development Scenario, although the total population is likely to be approximately 2,800, given the existing population of 270 (1981 Census).

8. Bob Quinn Lake Expansion

Comments as for Telegraph Creek (#7, above). No 1981 Census data are available. A town population growth of 2,800 may be projected.

9. Mess Lake Town

A townsite might be located at the western end of the Raspberry Pass just outside Edziza Park, serving the Schaft Creek project only. Its population would be approximately 2,800.

10. Atlin Expansion

If the ELUC grants Stage II approval-in-principle to the Adanac Molybdenum Project in the near future, most of the workforce will be housed in Atlin. Present population is about 250.

ATTACHMENT C2-3

CRITERIA FOR ENVIRONMENTAL ASSESSMENT OF TOWNSITE ALTERNATIVES

NORTHWEST ECONOMIC DEVELOPMENT STRATEGY

Prepared by:

Municipal Group
Policy and Research Branch
Ministry of Municipal Affairs

Prepared for:

Inter-Ministry Task Force on Northwest Economic Development

August 1982

CRITERIA FOR ENVIRONMENTAL ASSESSMENT
OF TOWNSITE ALTERNATIVES

NORTHWEST ECONOMIC DEVELOPMENT STRATEGY

Purpose

The environmental assessment is being undertaken to assist in developing a settlement strategy for the undeveloped portion of Northwest British Columbia.

Objectives

The objectives are to:

- assess generalized townsite/camp location areas in terms of their environmental characteristics and their implications for townsite/camp development
- identify environmental opportunities and constraints to townsite/camp development
- determine whether a townsite/camp is feasible and/or desirable in the generalized areas
- identify generalized mitigation and/or compensation requirements
- recommend generalized townsite/camp sites
- recommend where further site/area work should be undertaken in the future

Environmental Constraints
and Opportunities

The environmental assessment should amongst other factors consider the following factors which are relevant to townsite selection.

Environmental Constraints

- access
- terrain: elevation, slope
- geology/soils: urban suitability, geotechnical constraints
- soils: urban suitability, geotechnical constraints
- wildlife
- fisheries
- vegetation

- climate: temperature, winds, growing season, precipitation (rain/snow) sun shadow, frost
- waste disposal possibilities
- hydrology and flood hazard
- forest fire hazard
- avalanche hazard
- archeological sites
- traplines and guide territories
- recreational sites
- visual

Environmental Opportunities

- climate
- aspect with respect to sun
- views
- vegetation quality/variety
- ground and surface water supply
- recreation opportunities

ATTACHMENT C2-4

CRITICAL SITE SELECTION CRITERIA

NORTHWEST ECONOMIC DEVELOPMENT STRATEGY

Prepared by:

Municipal Group
Policy and Research Branch
Ministry of Municipal Affairs

Prepared for:

Inter-Ministry Task Force on Northwest
Economic Development

August 1982

Critical Site Selection Criteria

The following criteria are the most basic criteria for site development. These will provide reviewers with the tools to reduce the number of possible sites and select a first set of sites for further evaluation using the full set of criteria outlined in "Criteria for Environmental Assessment of Townsite Alternatives".

1. Elevation: sites should be located at the lowest possible elevation within the sub-area considering snowfall, frost, and exposure.
2. Slope: slopes should not exceed 7% on the average; neither should the site be a flat plain.
3. Hazard: sites should avoid areas of extensive hazard such as floodplains, snow avalanche areas, terrain instability, and soil instability.
4. Climate: sites should be located to minimize severe winds, maximize solar insulation, maximize frost free days, minimize snowfall, and minimize inversion potential.
5. Water Supply: sites should have a potential potable water supply.
6. Tenure: land should be available for development; private land vs crown land vs crown reserves.

LAND AREA REQUIREMENTS

Community	Population	Minimum Area*	Desirable Area*
Klappan Town - Kluayetz - Tsetia	3,000	165 acres	476 acres
Turnagain Town - Turnagain - Dease Lake	2,600	248 acres	476 acres
Kinaskan Town - Kinaskan - Iskut/Eddontenajon	3,600	220 acres	476 acres
Schaft Town - Kinaskan - Telegraph Creek - Bob Quinn Lake - Mess Lake	2,800	190 acres	476 acres

* Where a small settlement already exists, these additional development acreages may be needed.

APPENDIX C3

PROPOSED ROADS

BACKGROUND

The following points should be noted:

1. The Transportation Group has identified corridors within which road access might be constructed. These corridors are shown on the map in the back pocket. No attempt was made to identify any actual routes, and the linear road symbols are not even intended to show on which side of a river a road might be located.

2. The attached document summarizes the major road corridor options.

NORTHWEST ECONOMIC DEVELOPMENT

ROAD CORRIDORS

The existing road system and possible additions to the road network are shown on the attached schematic system diagram. This simplistic drawing should help readers to use the map in the back pocket.

The most important existing roads in the Study Area are as follows:

Existing Road	Corridors Along Route*	Route Description
Highway #37	Highway #37	Kitwanga to Yukon Border
Highway #37a	Bear	Meziadin to Stewart
District Road #10	----	Highway #37 to Cassiar
District Road #51	----	Dease Lake to Telegraph Creek
Highway #25	----	Kitimat to Terrace
Highway #16	----	Prince Rupert-Terrace-Kitwanga-Smithers-Vanderhoof
Atlin Road	----	Atlin to Yukon Border
Carcross-Skagway	----	Carcross (Yukon) to Skagway (Alaska)
Haines Road	----	Haines (Alaska) to Haines Junction (Yukon)
Alaska Highway	----	Whitehorse-Watson Lake-Fort Nelson-Dawson Creek
Greenville Road	Kiteen	Greenville to Highway #37 (private)
Terrace-Aiyansh Road	Kitsumkalum	- via Kalum Lake Rd. (District Rd. #3) - via B.C. Timber Road (private)

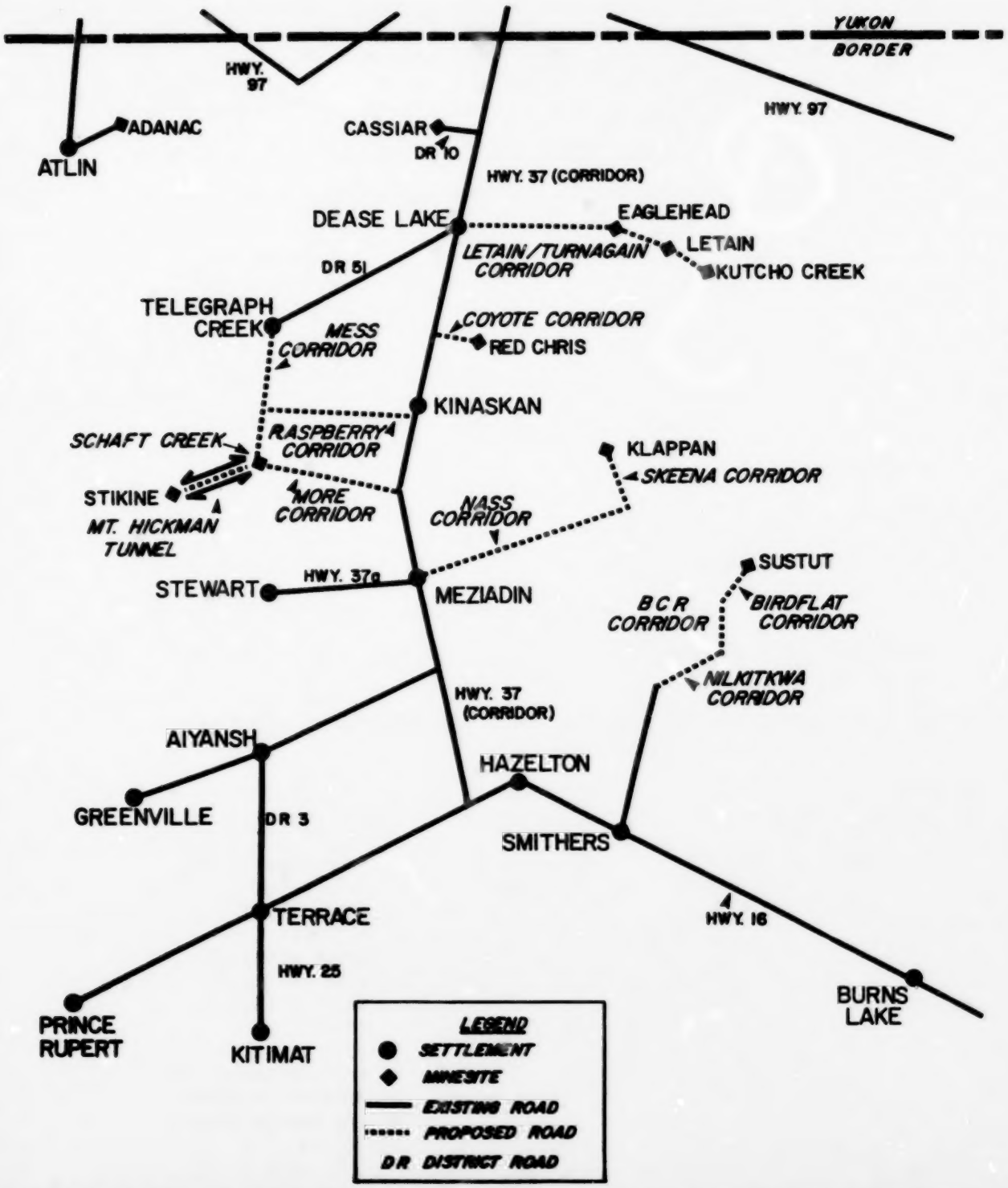
*Corridor names have been coined by ESIG, and are labelled on the map in the back pocket.

The proposed extensions to the existing road network in order to access the proposed mines are as follows:

Mining Group	Mine	Corridors Along Route*	Route Description
I	Sustut	Birdflat-BCR-Nilkitkwa	- from mine to Two Lake Creek - south along Birdflat Creek - south along BCR - west and south along Nilkitkwa River - join existing road from Smithers (via McKendrick Creek and Babine River).

NORTHWEST ECONOMIC DEVELOPMENT STUDY

ROAD SYSTEM DIAGRAM



Mining Group	Mine	Corridors Along Route*	Route Description
II	Klappan	Skeena-Nass	- from mine south along BCR to Groundhog Connection - past Mount McEvoy to Muckaboo Creek - west along Nass River to Highway #37 at Meziadin
III	Eaglehead) Letain) Kutcho)	Letain/Turnagain	- from Kutcho Creek mine north along Kutcho Creek - west along Letain Creek - west along Turnagain River - follow Cariboo Creek road to Dease Lake.
IV	Red Chris	Coyote	- follow Coyote Creek to Highway #37 near Tatogga Lake
	Schaft Creek	Mess (Option 1)	- from mine northwards along Schaft Creek to Raspberry Pass Trail - north along Mess Creek to Telegraph Creek.
		Mess-Raspberry (Option 2)	- from mine northwards along Schaft Creek to Raspberry Pass Trail - east along trail through Mount Edziza Park to Highway #37 south of Kinaskan
		More (Option 3)	- from mine southwards along More Creek to Highway #37 at Bob Quinn Lake.

Mining Group	Mine	Corridors Along Route*	Route Description
IV	Stikine	(tunnel)	- tunnel under Mount Hickman massif to Schaft Creek mine-site - then along one of the three options for linking the Schaft Creek mine to existing roads.

*Corridors names have been coined by ESIG, and are labelled on the map in the back pocket.

APPENDIX C4

PROPOSED RAILWAYS

BACKGROUND

The following points should be noted:

1. The Transportation Group has identified corridors within which rail access might be constructed. These corridors are shown on the map in the back pocket. No attempt is made to identify any actual routes, and the linear rail symbols are not even intended to show on which side of a river a railway might be located.

2. The attached document summarizes the major rail corridor options.

NORTHWEST ECONOMIC DEVELOPMENT

RAILWAY CORRIDORS

The existing rail system and possible additions to the rail network are shown on the attached schematic system diagram. This simplistic drawing should help readers to use the map in the back pocket.

The most important existing railways in the Study Area are as follows:

Existing Railway	Corridor(s) Along Route*	Route Description
BCR	BCR-Skeena-Little Klappan-Highway #37	- line north to Driftwood from Fort St. James (operational) - line north from Driftwood to Chipmunk Creek (constructed but not operational) - line north from Chipmunk Creek to Dease Lake (under construction)
CNR	-----	- Prince Rupert eastwards to Prince George, McBride and Alberta
White Pass	-----	- from Skagway via Lake Bennett to Whitehorse

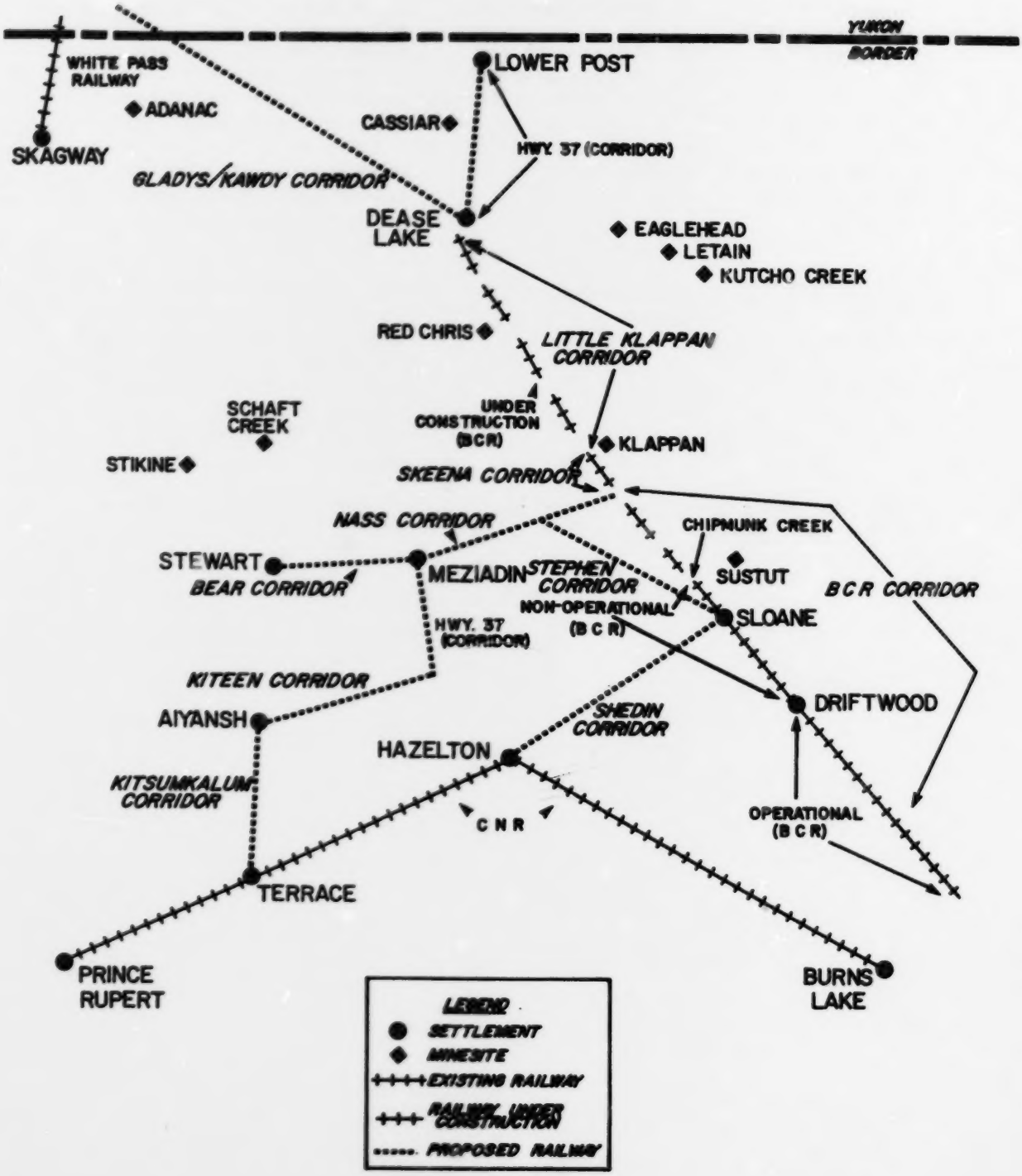
*Corridor names have been coined by ESIG, and are labelled on the map in the back pocket.

The proposed extensions to the existing rail network are not intended to access specific mines, but rather to improve regional services. The options are as follows:

Option	Corridor(s) Along Route*	Route Description
Dease Lake to Lower Post (Link 1)	Highway #37	- north from Dease Lake to Lower Post, following Highway #37
Dease Lake to Gladys Lake, the Yukon and Alaska (Link 2)	Gladys/Kawdy	- west from Dease Lake along District Road #51 (towards Telegraph Creek) - northwest through upper Tuya River valley to Tachilta Lakes - northwestwards across the Kawdy Plateau to Mount Snowdon - along north side of Gladys Lake to Yukon border.

NORTHWEST ECONOMIC DEVELOPMENT STUDY

RAIL SYSTEM DIAGRAM



Option	Corridor(s) Along Route*	Route Description
Groundhog Connection (BCR) to Terrace (CNR) (Link 3)	Nass-Highway #37-Kiteen-Kitsumkalum	- southwards from Groundhog along Nass valley to Highway #37 at Meziadin - south along Highway #37 to Greenville Road - southwestwards to Aiyansh - south to Terrace
Sloane (BCR) to Hazelton (CNR) (Link 4)	Shedin	- from Sloane (at junction of Skeena and Sustut Rivers) southwest along Shedin Creek to Hazelton
Sloane (BCR) to Stewart (Link 5)	Stephen-Nass-Bear	- from Sloane (at junction of Skeena and Sustut Rivers) west along the Skeena River and Damdochax Creek - west along Nass River to Highway #37 at Meziadin - west along Highway #37a to Stewart

*Corridor names have been coined by ESIG, and are labelled on the map in the back pocket.

APPENDIX C5

PROPOSED PIPELINE

BACKGROUND

For the Klappan Coal Project, it is possible that a coal slurry pipeline may be constructed to bring coal to Stewart for export. A proposed route has been identified which would parallel first the proposed coal mine access road to Meziadin, and then Highway #37a to Stewart. In sequence from the minesite to Stewart, it would follow the Skeena, Nass and Bear corridors (see map in back pocket for location of corridors).

APPENDIX C6

PROPOSED POWER SUPPLY SYSTEMS

BACKGROUND

The following points should be noted:

1. The Energy Group identified three separate and distinct options for providing power to the overall development.

   A - supply from existing integrated system.

   B - supply from local hydro-electric power developments

   C - supply from Klappan Thermal Power Project

   For the purposes of this study, the possibility of mixing these options was not considered, although the results of the study suggest that this approach to power supply is preferable.

2. The sources of supply and the associated transmission line corridor networks are shown on the map in the back pocket. No attempt is made to identify actual transmission line aligrments, and the linear line symbols are not even intended to show on which side of a river a line might be located.

3. It should be noted that all options assume that the Granduc mine will continue to generate its own power.

4. Attachment C6-1, a 1982-07-28 inter-office memo from A. Langmuir to K.G. Peterson (B.C. Hydro), provides some background on the level of analysis upon which transmission line corridor selection has been based to date. It also indicates potential right-of-way widths for each type of transmission line.

5. Attachment C6-2 summarizes the major electrical supply options.

6. On-site diesal generation was not originally part of the study terms of reference since it does not require a regional power supply system. However, the present studies have suggested that this may be the most economic option for some mines.

Inter-office memo B.C. Hydro

ATTACHMENT C6-1

MEMO TO: Mr. K.G. Peterson
HO-20

28 July 1982

FROM: A. Langmuir
EG-23

FILE: 415

SUBJECT: Transmission Line Corridor Maps

As required in the work schedule for the Northwest Development Studies dated 20 July 1982 attached are three maps outlining proposed transmission line corridors to supply the ten mines selected for study by the Ministry of Energy, Mines and Petroleum Resources. The following comments should be submitted with the maps to avoid misunderstandings as to the quality of the information presented.

1. On Map 1, the 500 kV corridors selected between Skeena (near Terrace) and Telkwa (near Houston) and the proposed Stikine collector station, located about 20 km north of the Village of Iskut, represent the technically preferred option for the overall Iskut-Stikine Hydroelectric development. Only one line and one route would be selected for supply to the mines from the integrated system prior to any Iskut/Stikine hydroelectric development. Extensive engineering studies including environmental factors have been conducted on this proposed development and a report on these studies is being prepared for issue later this year. These engineering studies have progressed to the point where the technical feasibility of the proposed corridor is not seriously in doubt.

2. Preliminary field investigations on the 230 kV corridors from Bob Quinn Lake to Schaft Creek and Stikine Copper were conducted by our Route Engineering Department a year ago at the request of the mining companies. No environmental impact studies have been done by B.C. Hydro.

3. All other corridors shown on the attached maps have been prepared from a cursory review of available maps without field investigations or consultation with the Route Engineering Department. Further technical, economic and environmental review may dictate selection of alternate corridors or transmission voltages.

...../2

4. Single circuit supply to each load centre has been assumed except along the 500 kV corridors from Skeena and Telkwa to Stikine Z where sufficient right-of-way to accommodate the ultimate stage of the Iskut-Stikine Project may be acquired.

5. Typical transmission line right-of-way widths are:

Circuit	Right-of-Way Width
Skeena x Meziadin Lake (1 x 500 kV line)	64 m
Telkwa x Meziadin Lake (2 x 500 kV lines)	118 m
Meziadin Lake x Bob Quinn Lake (3 x 500 kV lines)	172 m
Bob Quinn Lake x Stikine Z (2 x 500 kV lines)	118 m
Typical 230 kV Single Circuit	30 m
Typical 138 kV Single Circuit	22 m
Typical 69 kV Single Circuit	18 m

6. On Maps 1 and 3, although no connection is shown, it is expected that Telegraph Creek would be supplied using a 25 kV distribution circuit from the Stikine Z station.

7. On Map 2, small hydro sites for the Stewart and Sustut areas are still to be identified. No suitable maps are available for the Sustut area as far as we know. No sites have been identified in the Klappan area. Klappan and Sustut loads could be supplied from More Creek at least until the year 2000 when Stikine Copper has been scheduled to start up.

8. Based on the load forecast, we recommend that the "Small Hydro" and the "Early More Creek" options be combined into a single alternative since they seem to be mutually exclusive.

A. Langmuir.

CS/sw
Attachments

cc: Mr. J.C. Dawson, HO-19
Mr. D.R. Forrest, EG-24
Mr. C.K. Harman, EG-19
Mr. J.L. Batho, EG 23

NORTHWEST ECONOMIC DEVELOPMENT

ATTACHMENT C6-2

POWER SUPPLY

No part of the Study Area north of Stewart has yet been linked to the Province's integrated power grid. Given this circumstance, B.C. Hydro has proposed three alternative systems for power supply to the proposed mines, and these are shown on the three schematic system diagrams which accompany this attachment. These simplistic drawings should help readers to use the map in the back pocket.

OPTION A - SUPPLY FROM INTEGRATED SYSTEM

The backbone of the system would be the following 500-kV network:

Corridor(s) Along Route*	Route Description	Right-of-Way Width
Highway #37	- Telkwa switching station to Meziadin switching station	118m (two lines)
Kitsumkalum-Lavender	- Terrace to Meziadin switching station	64m (one line)
Highway #37	- Meziadin switching station to Bob Quinn Lake switching station	172m (three lines)
Highway #37	- Bob Quinn Lake switching station to Stikine Z switching station	118m (two lines)

*Corridor names have been coined by ESIG, and are labelled on the map in the back pocket.

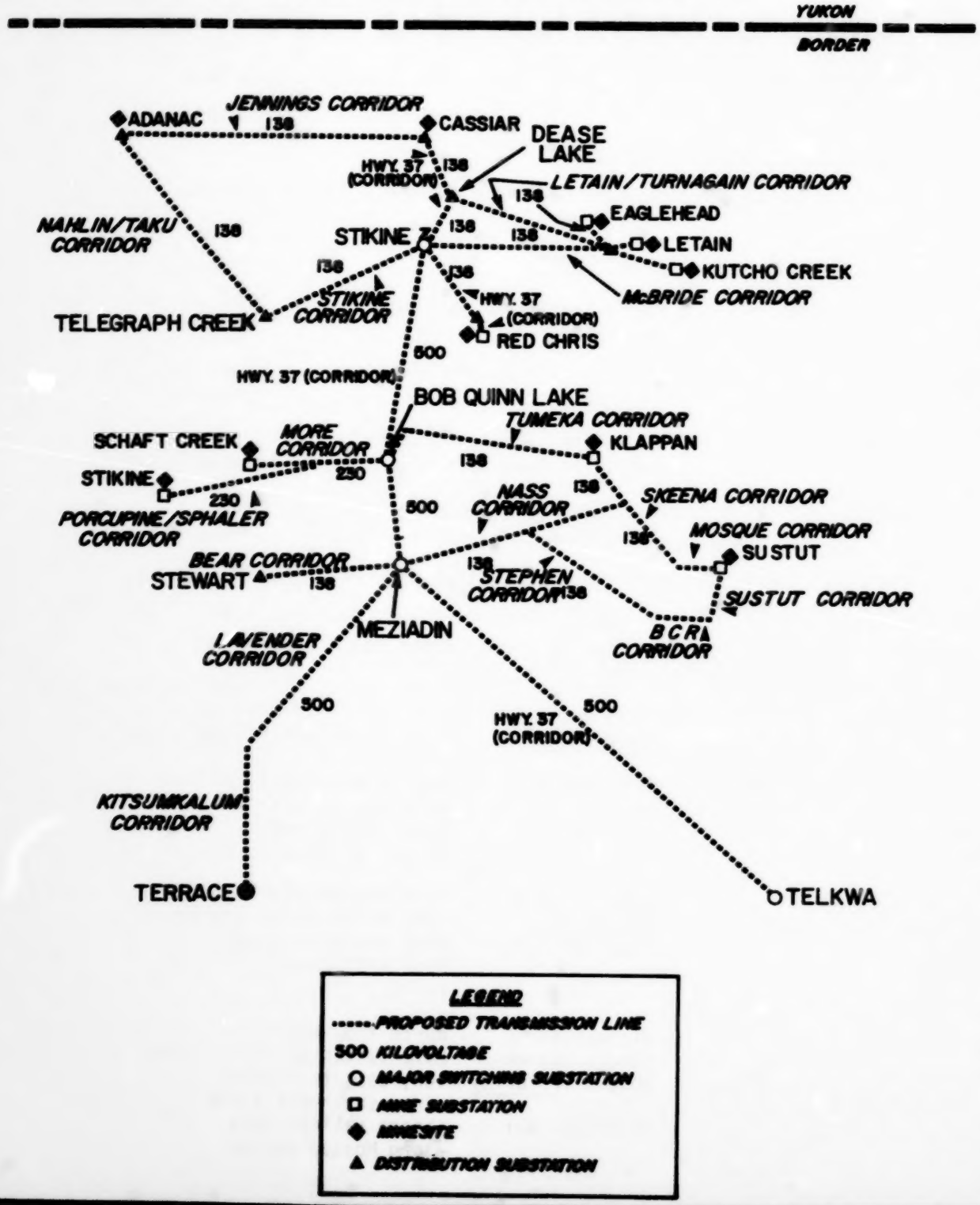
From this 500-kV system, the individual mines could be serviced by the following transmission line network:

Mining Group	Mine	Corridor(s) Along Route*	Route Description	Kilovoltage (Right-of-way width)
I	Sustut	Nass-Skeena-Mosque (Corridor A1)	- east from Meziadin switching station via Nass, Skeena and Mosque valleys	138 (22m)
		Nass-Stephen-BCR-Sustut (Corridor A2)	- east from Meziadin switching station via Nass valley, Stephen Peak and Sustut valley	138 (22m)
		Highway #37-Tumeka-Skeena-Mosque (Priority Option) (Corridor A3)	- north from Bob Quinn Lake switching station, east to Klappan mine, southeast along Skeena valley, east along Mosque valley	138 (22m)

NORTHWEST ECONOMIC DEVELOPMENT STUDY

POWER SUPPLY SYSTEM DIAGRAM

A-SUPPLY FROM INTEGRATED GRID



Mining Group	Mine	Corridor(s) Along Route*	Route Description	Kilovoltage (Right-of-way width)
II.	Klappan	Highway #37-Tumeka (Corridor A1)	- north from Bob Quinn Lake switching station, east to mine	138 (22m)
III.	Eaglehead) Letain) Kutcho)	Highway #37-Letain/Turnagain (Corridor A1)	- north from Stikine Z switching station to Dease Lake distribution substation, east to Kutcho mine	138 (22m)
		McBride (Priority Option) (Corridor A2)	- east from Stikine Z switching station via Stikine and McBride Rivers to Letain distribution substation	138 (22m)
IV.	Red Chris	Highway #37 (Priority Option) (Corridor A1)	- south from Stikine Z switching station, parallel to 500-kV line for most of route	138 (22m)
	Schaft Creek	More (Priority Option) (Corridor A1)	- northwest from Bob Quinn Lake switching station via More valley	230 (30m)
	Stikine	More-Porcupine/Sphaler (Priority Option) (Corridor A1)	- northwest from Bob Quinn Lake switching station via More, Sphaler, Porcupine and Stikine valleys	230 (30m)
V.	Adanac	Stikine-Nahlin/Taku (Corridor A1)	- west from Stikine Z switching station to Telegraph Creek distribution substation, northwestwards across Nahlin and Taku Plateaus	138 (22m)
		Highway #37-Jennings (Priority Option) (Corridor A2)	- north from Stikine Z switching station to Dease Lake and Cassiar distribution substations, westwards via Jennings valley	138 (22m)

*Corridor names have been coined by ESIG, and are labelled on the map in the back pocket.

OPTION B - SUPPLY FROM LOCAL HYDRO-ELECTRIC DEVELOPMENTS

This system is based on local transmission to mines from five hydro-electric power projects. It should be noted that B.C. Hydro still intends to identify small potential hydro-electric dam sites for the Klappan and Sustut areas. In the meantime, the More Creek dam may be able to supply both mines at least until 2000 AD, when the Stikine Copper Project is scheduled to commence production.

Mining Group	Mine	Hydro-Electric Damsite(s)	Transmission Line Corridor(s)*	Kilovoltage (Right-of-way Width)
I.	Sustut	More Creek	Highway #37-Tumeka-Skeena-Mosque (Corridor B1)	138 (22m)
II.	Klappan	More Creek	Highway #37-Tumeka (Corridor B1)	138 (22m)
III.	Eaglehead) Letain) Kutcho)	Turnagain River III (58°39'N 128°07'W)	Kutcho/Turnagain-Letain/Turnagain (Corridor B1)	69 (18m)
IV.	Red Chris	Eaglenest Creek (57°38'N 129°72'W) plus Unnamed Creek (57°33'N 129°44'W)	Little Klappan (Corridor B1)	69 (18m)
	Schaft Creek	More Creek	More (Corridor B1)	230 (30m)
	Stikine	More Creek	More-Porcupine/ Sphaler (Corridor B1)	230 (30m)
V.	Adanac	Surprise Lake-Atlin Lake (59°33'N 133°39'W)	Pine (Corridor B1)	69 (18m)

*Corridor names have been coined by ESIG, and are labelled on the map in the back pocket.

For the existing mine at Cassiar, a dam is proposed on the Cottonwood River (59°10'N 130°15'W), with a 69-kV transmission line to the mine.

OPTION C - SUPPLY FROM KLAPPAN THERMAL POWER PROJECT

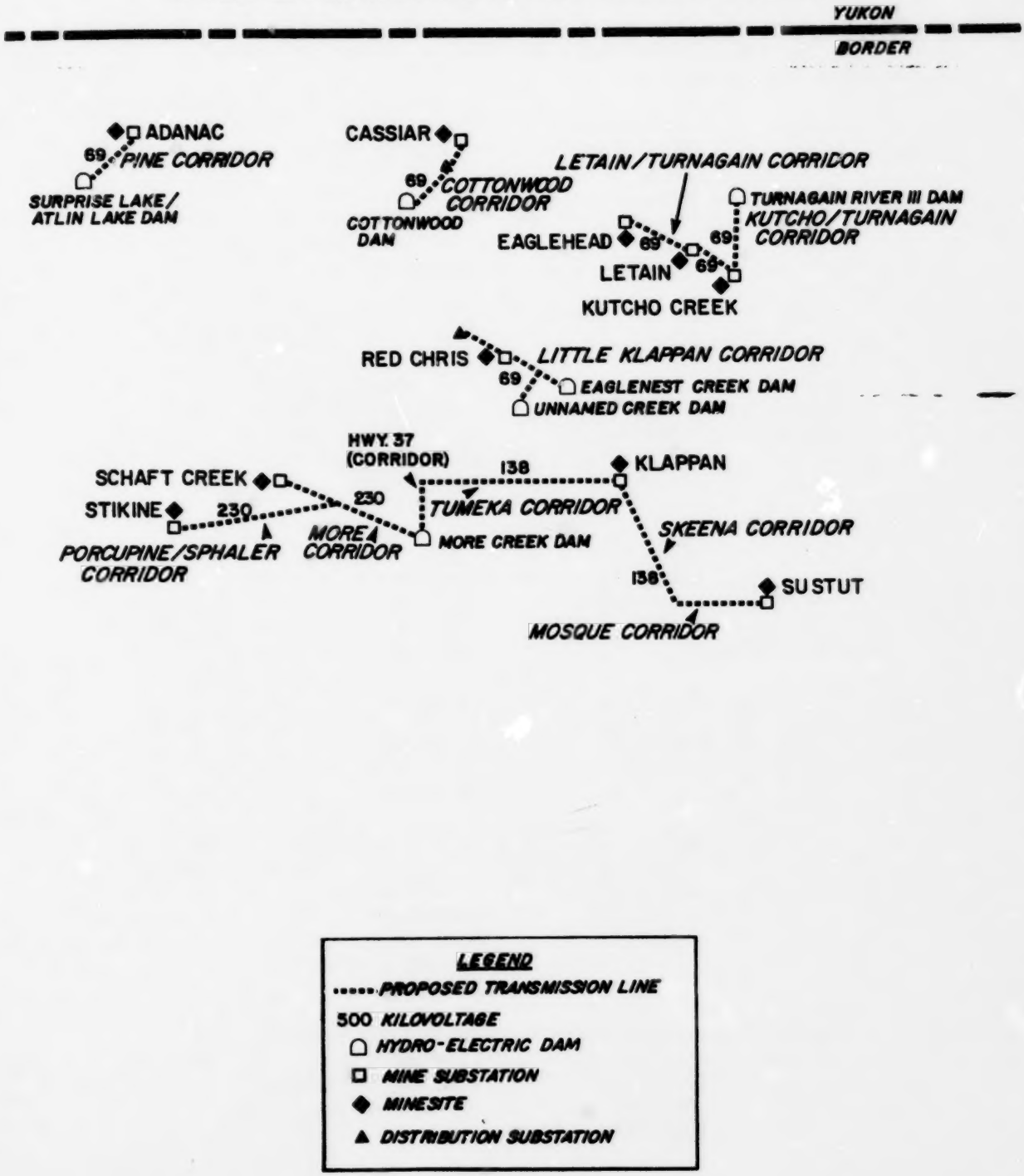
A thermal power plant could be constructed near the Klappan Coal Project. The backbone of the associated transmission line network would be:

- either, a 230-kV line westwards from the Klappan mine (along the Tumeka corridor) to a major switching station south of Refuge Lake, then northwards (along the Highway #37 corridor) to the Stikine Z

NORTHWEST ECONOMIC DEVELOPMENT STUDY

POWER SUPPLY SYSTEM DIAGRAM

B-SUPPLY FROM LOCAL HYDRO-ELECTRIC DEVELOPMENTS.



LEGEND

- ..... PROPOSED TRANSMISSION LINE
- 500 KILOVOLTAGE
- ⌂ HYDRO-ELECTRIC DAM
- □ MINE SUBSTATION
- ◆ MINESITE
- ▲ DISTRIBUTION SUBSTATION

switching station (the priority option)

- or a 230-kV line westwards (along the Tumeka corridor), then northwards (along the Klappan and Highway #37 corridors) to the Stikine Z switching station.

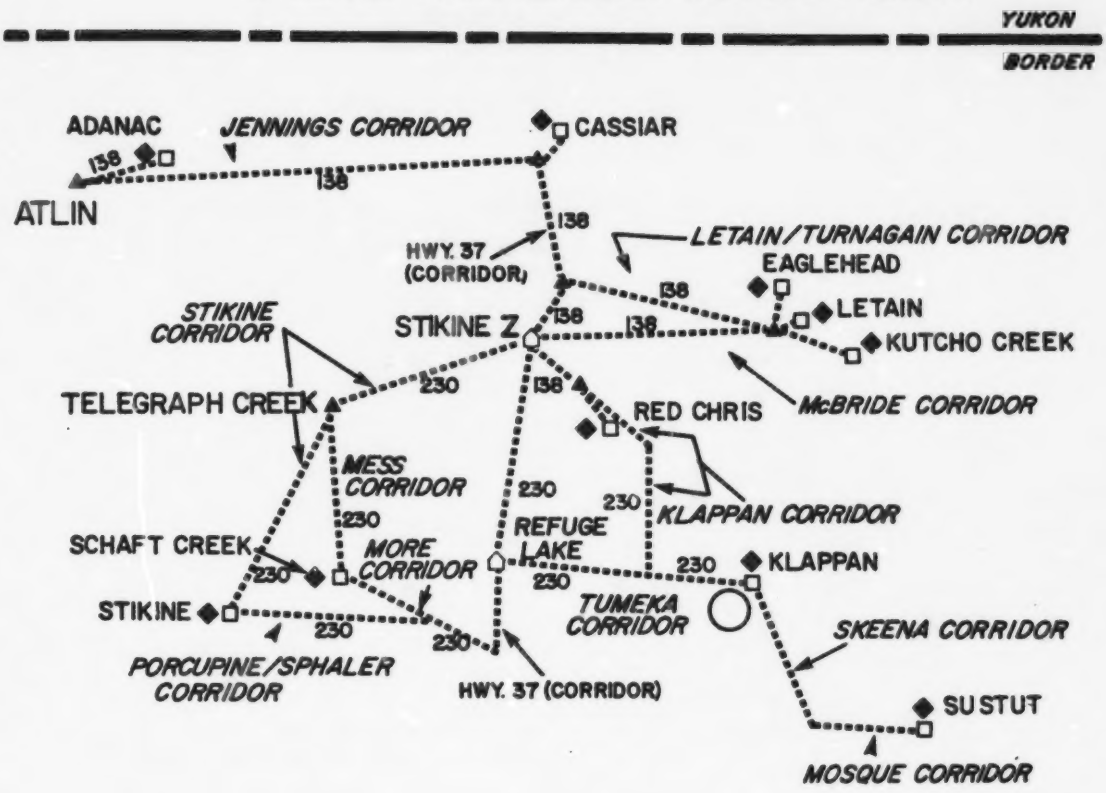
In either case, a 30-metre right-of-way is envisaged. From this 230-kV system, the individual mines could be serviced by the following transmission line network:

Mining Group	Mine	Corridor(s) Along Route*	Route Description	Kilovoltage (Right-of-way Width)
I	Sustut	Skeena-Mosque (Priority Option) (Corridor C1)	- southeastwards from Klappan plant via Skeena and Mosque valleys	138 (22m)
II	Klappan	on-site generation	N/A	N/A
III	Eaglehead) Letain) Kutcho)	McBride (Priority Option) (Corridor C2)	- east from Stikine Z switching station via Stikine and McBride Rivers to Letain distribution substation	138 (22m)
		Highway #37-Letain/Turnagain (Corridor C1)	- north from Stikine Z switching station to Dease Lake distribution substation, east to Kutcho mine	138 (22m)
IV.	Red Chris	Highway #37 (Priority Option) (Corridor C1)	south from Stikine Z switching station parallel to 230-kV trunk line for most of route	138 (22m)
		Highway #37 (alternative) (Corridor C2)	if Klappan 230-kV line built, locate distribution substation north of mine, run short feeder southwards to mine.	138 (22m)
	Schaft Creek	Highway #37-More (Priority Option) (Corridor C1)	south from Refuge Lake switching station, northwest of More valley	230 (30m)

NORTHWEST ECONOMIC DEVELOPMENT STUDY

POWER SUPPLY SYSTEM DIAGRAM

C-SUPPLY FROM KLAPPAN THERMAL PROJECT



LEGEND

- PROPOSED TRANSMISSION LINE
- 500 KILOVOLTAGE
- KLAPPAN THERMAL POWER PLANT
- MINE SUBSTATION
- MINESITE
- DISTRIBUTION SUBSTATION
- MAJOR SWITCHING SUBSTATION

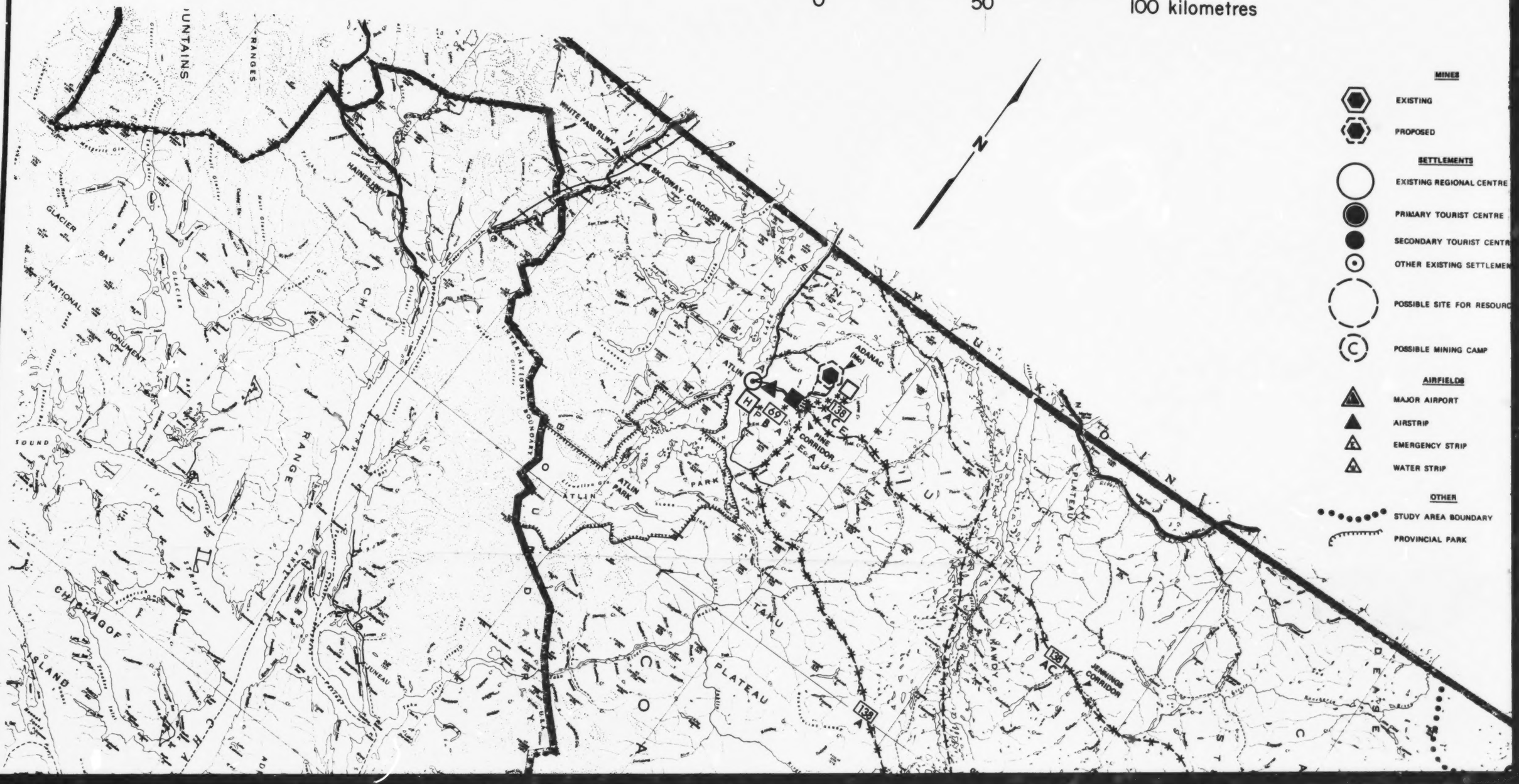
Mining Group	Mine	Corridor(s) Along Route*	Route Description	Kilovoltage (Right-of-way Width)
		Stikine-Mess (Corridor C2)	- west from Stikine Z switching station to distribution substation at Telegraph Creek, south along Mess valley	230 (30m)
	Stikine	Highway #37-More-Porcupine/Sphaler (Priority Option) (Corridor C1)	- south from Refuge Lake switching station, northwest up More valley, west via Sphaler, Porcupine and Stikine valleys.	230 (30m)
		Stikine (Corridor C2)	west from Stikine Z switching station then southwest along Stikine valley to mine	230 (30m)
V.	Adanac	Highway #37-Jennings (Priority Option) (Corridor C1)	- north from Stikine Z switching station to Dease Lake and Cassiar distribution stations, westwards via Jennings valley.	138 (22m)

*Corridor names have been coined by ESIG, and are labelled on the map in the back pocket.

NORTHWEST ECONOMIC DEVELOPMENT STUDY - DEVELOPMENT OPTI

SCALE 1:1 000 000

0 50 100 kilometres



ELOPMENT OPTIONS

es

LEGEND

MINES

EXISTING

PROPOSED

SETTLEMENTS

EXISTING REGIONAL CENTRE

PRIMARY TOURIST CENTRE

SECONDARY TOURIST CENTRE

OTHER EXISTING SETTLEMENT

POSSIBLE SITE FOR RESOURCE TOWN

POSSIBLE MINING CAMP

AIRFIELDS

MAJOR AIRPORT

AIRSTRIP

EMERGENCY STRIP

WATER STRIP

OTHER

STUDY AREA BOUNDARY

PROVINCIAL PARK

LINEAR DEVELOPMENTS

EXISTING MAJOR HIGHWAY

EXISTING MINOR ROAD

PROPOSED RESOURCE ROAD CORRIDOR

PROPOSED ROAD TUNNEL

EXISTING RAILWAY

RAILWAY UNDER CONSTRUCTION

PROPOSED RAILWAY CORRIDOR

PROPOSED COAL SLURRY PIPELINE CORRIDOR

PROPOSED 500-kV TRANSMISSION CORRIDOR (500)

PROPOSED 230-kV TRANSMISSION CORRIDOR (230)

PROPOSED 138-kV TRANSMISSION CORRIDOR (138)

PROPOSED 69-kV TRANSMISSION CORRIDOR (69)

PROPOSED BARGING ROUTE

TRANSMISSION SUBSTATIONS

PROPOSED MAJOR SWITCHING SUBSTATION

PROPOSED DISTRIBUTION SUBSTATION

PROPOSED MINE SUBSTATION

PROPOSED HYDRO-ELECTRIC POWER GENERATION SITE (H)

NOTES

1. THREE ELECTRICAL POWER SUPPLY SYSTEMS ARE PROPOSED AS ALTERNATES, AND ARE LABELLED ON THE MAPSHEET AS FOLLOWS:

   A – SUPPLY FROM THE EXISTING INTEGRATED POWER GRID
   B – SUPPLY FROM NEW LOCAL HYDRO-ELECTRIC DEVELOPMENTS
   C – SUPPLY FROM PROPOSED KLAPPAN THERMAL POWER PROJECT

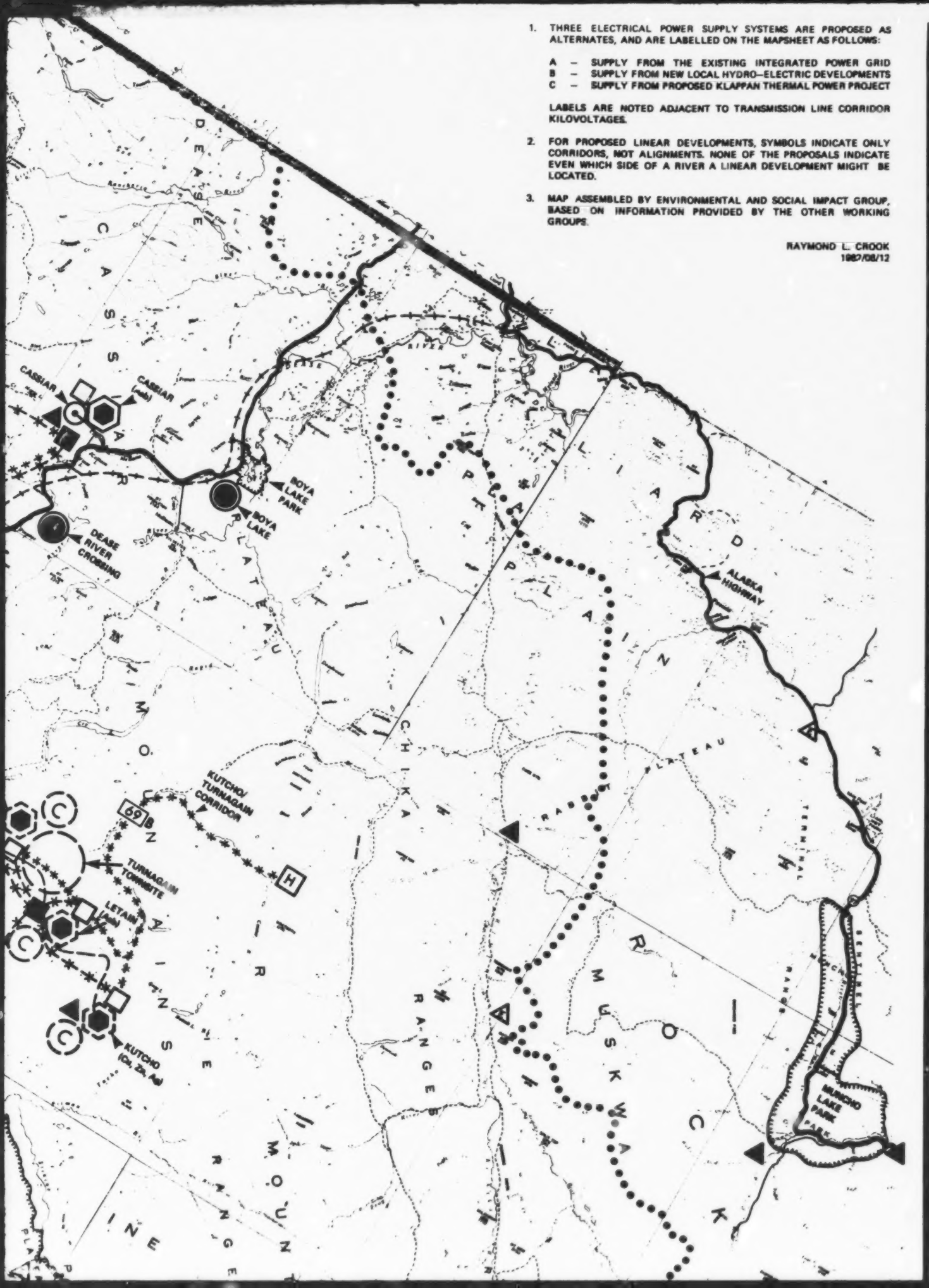
   LABELS ARE NOTED ADJACENT TO TRANSMISSION LINE CORRIDOR KILOVOLTAGES.

2. FOR PROPOSED LINEAR DEVELOPMENTS, SYMBOLS INDICATE ONLY CORRIDORS, NOT ALIGNMENTS. NONE OF THE PROPOSALS INDICATE EVEN WHICH SIDE OF A RIVER A LINEAR DEVELOPMENT MIGHT BE LOCATED.

3. MAP ASSEMBLED BY ENVIRONMENTAL AND SOCIAL IMPACT GROUP, BASED ON INFORMATION PROVIDED BY THE OTHER WORKING GROUPS.

RAYMOND L. CROOK
1982/08/12

COAST MOUNTAINS
PLATEAU
ADMIRALTY ISLAND
BARANOF ISLAND
KUPREANOF ISLAND
KUIU ISLAND
CHICHAGOF ISLAND
PRINCE OF WALES ISLAND
DIXON ENTRANCE
CLEVELAND PENINSULA
ANNETTE ISLAND
METLAKATLA
KETCHIKAN
WRANGELL
PETERSBURG
SITKA
JUNEAU
HAINES
SKAGWAY
WRANGELL MOUNTAINS
ST. ELIAS MOUNTAINS
PORCUPINE/SMALLER CORRIDOR
STIKINE CORRIDOR
NOSE CORRIDOR
NASS CORRIDOR
KLAWAK CORRIDOR
TUMAKA CORRIDOR
TATOOSH LAKE
KLUTCHMAN CORRIDOR
TELEGRAPH CREEK TOWNSITE
NESS LAKE TOWNSITE
DEASE LAKE TOWNSITE
DEASE RIVER CORRIDOR
HIGHWAY NO. 37
COTTONWOOD CORRIDOR
CASSIAR
BOVA LAKE PARK
GLADYS/KAMDY CORRIDOR
NAHLIN/TAKU CORRIDOR
JENNINGS CORRIDOR
TAKU
NOTLEKH
EAGLE HEAD (Ice, Mt.)
LITTLE KLAWAK CORRIDOR
KLAWAK
TUMAKA TOWNSITE
MUD CREEK
SOUTH KLUTCHMAN CORRIDOR
KLUTCHMAN TOWNSITE
LITTLE KLUTCHMAN CORRIDOR
KLUTCHMAN (Ice, Mt.)
KLUTCHMAN TOWNSITE
EAGLE HEAD (Ice, Mt.)
TATOOSH LAKE
EDDIZA PARK
NASS CORRIDOR
NESS LAKE TOWNSITE
STIKINE (Ice)
MOUNT SCHULTY (Ice, Mt.)
STIKINE CORRIDOR
TELEGRAPH CREEK TOWNSITE
NOTLEKH
DEASE LAKE
DEASE LAKE TOWNSITE
DEASE RIVER CORRIDOR
HIGHWAY NO. 37
COTTONWOOD CORRIDOR
CASSIAR
BOVA LAKE
BOVA LAKE PARK
GLADYS/KAMDY CORRIDOR
NAHLIN/TAKU CORRIDOR
JENNINGS CORRIDOR
TAKU PLATEAU
ALASKA
CANADA
BRITISH COLUMBIA
YUKON TERRITORY
ALASKA PANHANDLE
INSIDE PASSAGE
DIXON ENTRANCE
CLEVELAND PENINSULA
ANNETTE ISLAND
METLAKATLA
KETCHIKAN
WRANGELL
PETERSBURG
SITKA
JUNEAU
HAINES
SKAGWAY
WRANGELL MOUNTAINS
ST. ELIAS MOUNTAINS
COAST MOUNTAINS
PLATEAU
ADMIRALTY ISLAND
BARANOF ISLAND
KUPREANOF ISLAND
KUIU ISLAND
CHICHAGOF ISLAND
PRINCE OF WALES ISLAND


1. THREE ELECTRICAL POWER SUPPLY SYSTEMS ARE PROPOSED AS ALTERNATES, AND ARE LABELLED ON THE MAPSHEET AS FOLLOWS:
A – SUPPLY FROM THE EXISTING INTEGRATED POWER GRID
B – SUPPLY FROM NEW LOCAL HYDRO–ELECTRIC DEVELOPMENTS
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LABELS ARE NOTED ADJACENT TO TRANSMISSION LINE CORRIDOR KILOVOLTAGES.
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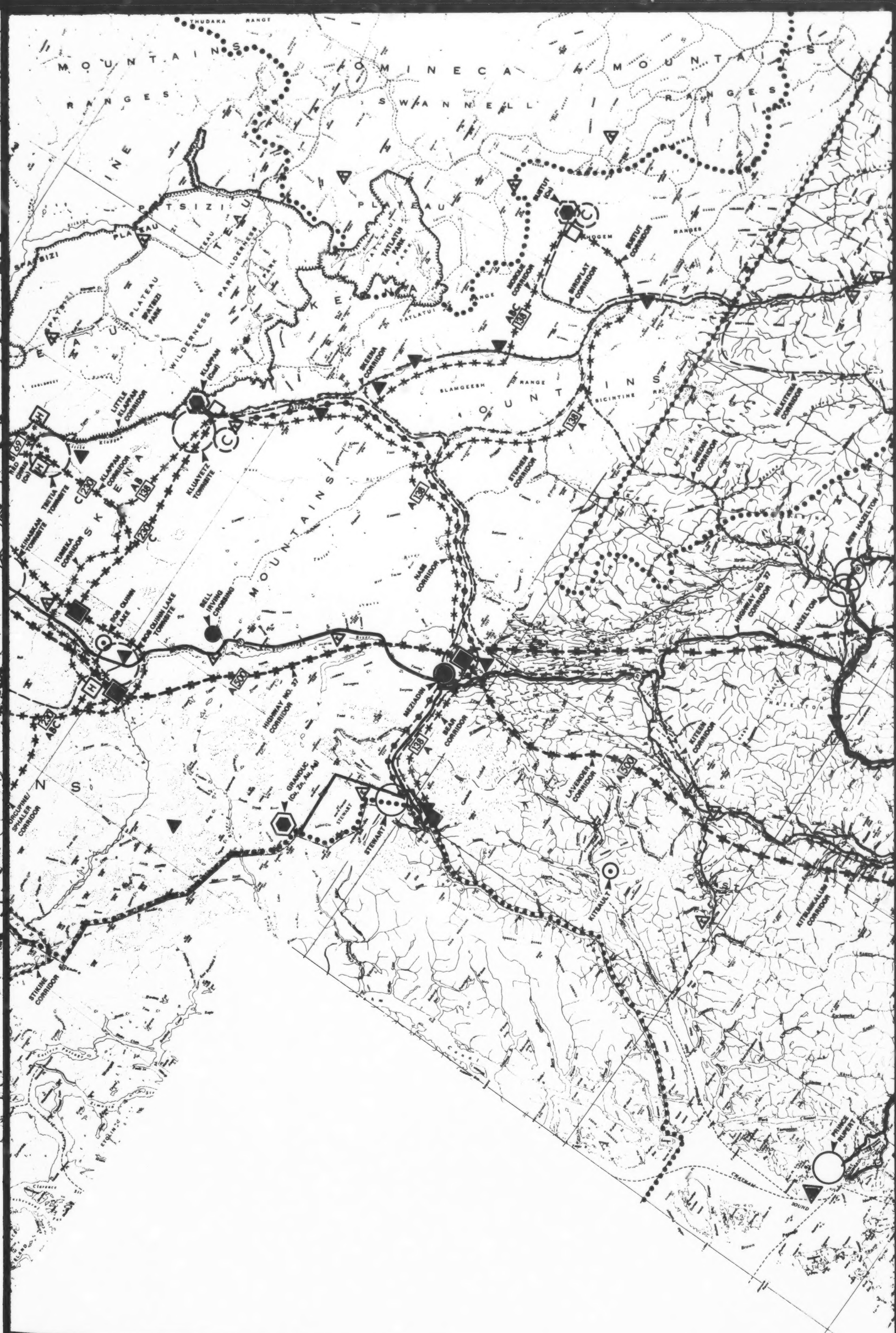
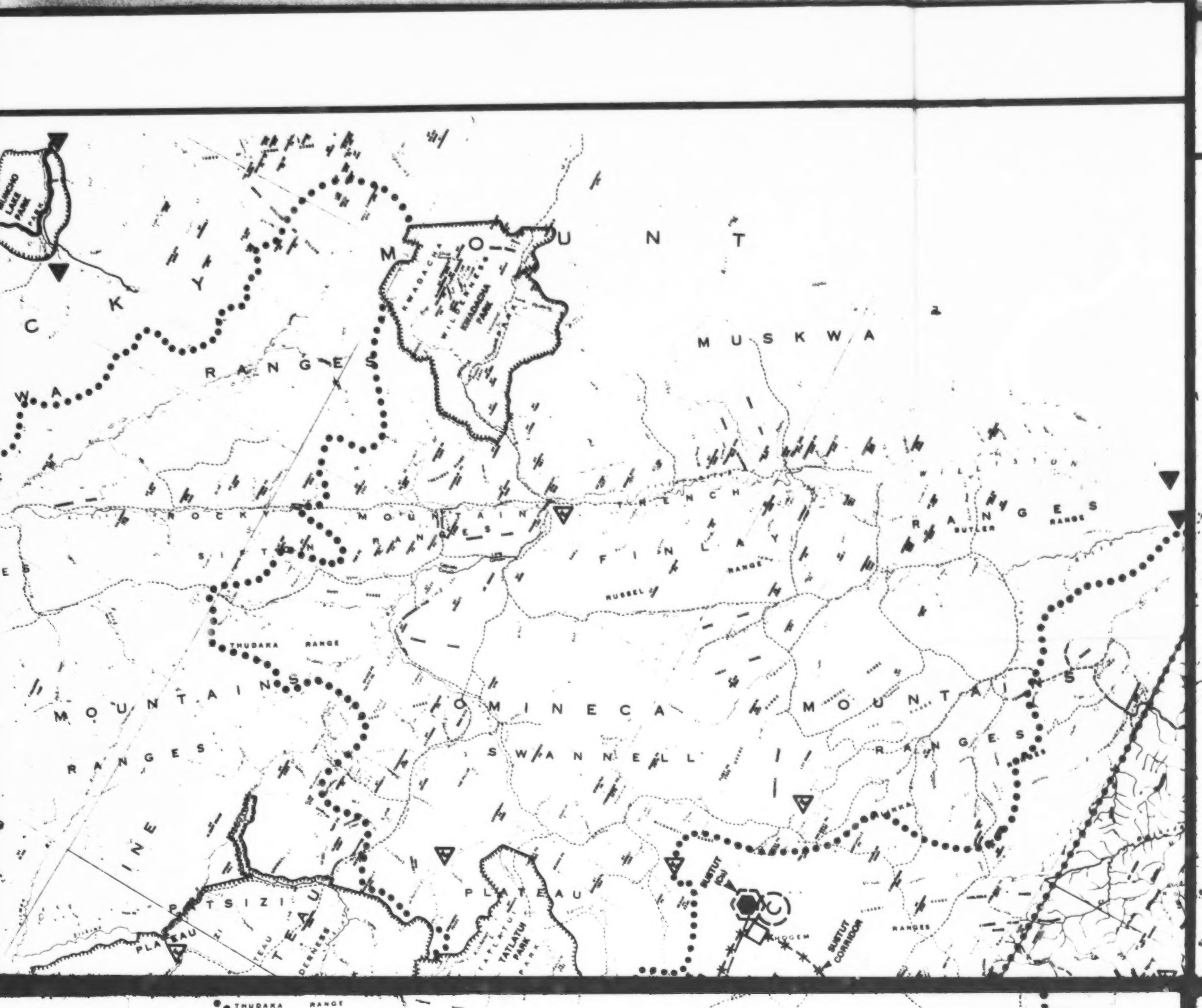
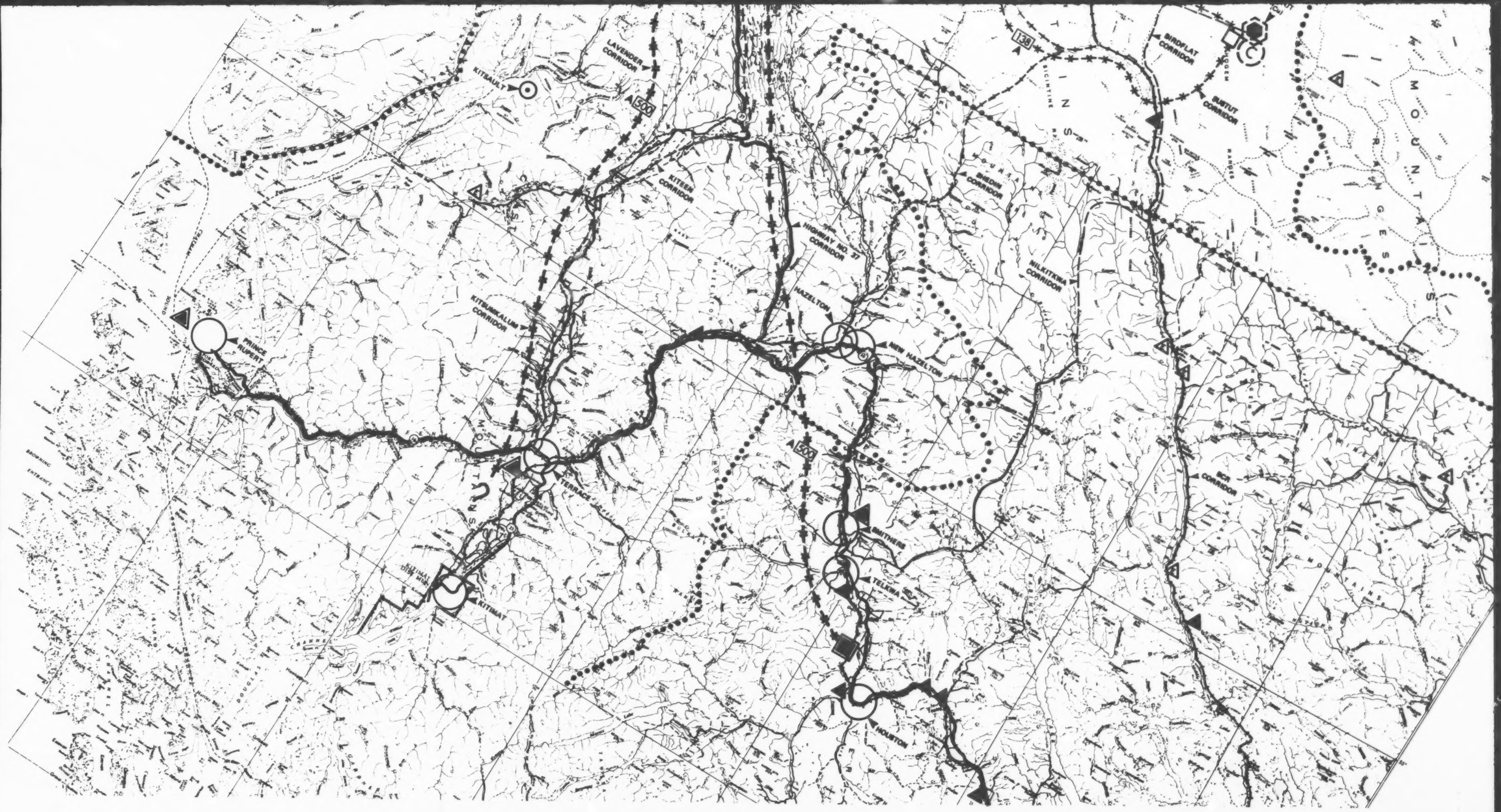
3. MAP ASSEMBLED BY ENVIRONMENTAL AND SOCIAL IMPACT GROUP, BASED ON INFORMATION PROVIDED BY THE OTHER WORKING GROUPS.
RAYMOND L. CROOK
1982/08/12
CASSIAR
CASSIAR (Asb)
BOYA LAKE PARK
BOYA LAKE
DEASE RIVER CROSSING
ALASKA HIGHWAY
KUTCHO/ TURNAGAIN CORRIDOR
69
TURNAGAIN TOWNSITE
LETAIN (Asb)
KUTCHO (Cl, Zn, Au)
MUNCHO LAKE PARK
DEASE
CASSIAR
PLATEAU
MOUNTAINS
RANGE
MACKENZIE


MOUNTAINS
RANGES
THUDAKA RANGE
OMINECA MOUNTAINS
SWANNELL RANGES
PLATEAU
PLATEAU WILDERNESS PARK
TATLATUI PARK
KENNEDY CORRIDOR
SKEENA MOUNTAINS
KLAPPAN CORRIDOR
LITTLE KLAPPAN CORRIDOR
KLUAYETZ TOWNSITE
TSETSA TOWNSITE
KWADACHA TOWNSITE
TUMEKA CORRIDOR
BOB QUINN LAKE
BOB QUINN LAKE TOWNSITE
BELL IRVING CROSSING
HIGHWAY NO. 37 CORRIDOR
GRANDUC (EL. 2,215, Am. rail)
PORCUPINE/SPHALER CORRIDOR
STIKINE CORRIDOR
MEZIADIN
SEAL CORRIDOR
STEWART
SKEENA CORRIDOR
BICINTINE RANGE
STERNER CORRIDOR
NAS CORRIDOR
BIRDFLAT CORRIDOR
BIG EDDY CORRIDOR
HAZELTON
HIGHWAY NO. 37 CORRIDOR
HALLEYBURY CORRIDOR
KITSEGUECLA CORRIDOR
JAVERDAC CORRIDOR
KITWANGA
KITSEGUKLA CORRIDOR
PRINCE RUPERT
CHATHAM SOUND


MUSKWA
RANGES
ROCKY MOUNTAIN TRENCH
FINLAY RANGE
RUSSEL RANGE
WILLISTON RANGES
BUTLER RANGE
THUDAKA RANGE
MOUNTAINS
OMINECA MOUNTAINS
SWANNELL RANGES
PLATEAU
TATLATUI PARK
SUSTUT
SUSTUT CORRIDOR
RANGES


LAVENDER CORRIDOR
KITSAULT
A 500
KITEEN CORRIDOR
KITELMALLUM CORRIDOR
HIGHWAY NO. 37 CORRIDOR
SKEENA CORRIDOR
NILKITKWA CORRIDOR
HAZELTON
NEW HAZELTON
SMITHERS
TELKWA
HOUSTON
PRINCE RUPERT
TERRACE
KITIMAT
138
BIRDFLAT CORRIDOR
SUSTUT CORRIDOR
BCR CORRIDOR
MOUNTAINS
RANGES
BROWNING ENTRANCE
DOUGLAS CHANNEL

MOUNTAINS
RANGES
BCR CORRIDOR
Province of British Columbia

POOR

QUALITY

ORIGINAL